REPORT RESUMES

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FROCEEDINGS OF THE TECHNICIAN MANFOWER CONFERENCE, A CONFERENCE CONCERNING THE EDUCATION AND UTILIZATION OF SEMI-PROFESSIONAL TECHNICAL PERSONNEL (UNIVERSITY OF WASHINGTON, SEATTLE, OCTOBER 23-24, 1963).

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THIS 1963 CONFERENCE WAS ATTENDED BY REPRESENTATIVES FROM BOTH EDUCATION AND INDUSTRY. ITS THREE PURPOSES WERE TO INFORM PROSPECTIVE EMPLOYERS OF CURRENT TRENDS IN TECHNICIAN EDUCATION, TO PERMIT EXCHANGE OF INFORMATION AND OPINION ON THIS TRAINING, AND TO ENCOURAGE SUGGESTIONS FOR ITS IMPROVEMENT. THE TOPICS COVERED THE OUTLOOK FOR TECHNICAL EMPLOYMENT BRIEFLY FROM THE NATIONAL VIEWPOINT AND IN DETAIL BY THREE NORTHWEST SPEAKERS--(1) THE EMPLOYER'S VIEW OF THE IMPORTANCE OF THE TECHNICIAN (EMPLOYMENT IN THE AIRCRAFT INDUSTRY, PROSPECTS IN NURSING AND OTHER HEALTH FIELDS, AND OPPORTUNITIES IN GOVERNMENT), (2) CURRENT EDUCATIONAL PROGRAMS FOR TECHNICIANS (ADULT EDUCATION, COMMUNITY COLLEGES, STATE COLLEGES, PRIVATE COLLEGES, VOCATIONAL-TECHNICAL INSTITUTES, AND THE UNIVERSITIES), AND (3) SUGGESTIONS FOR ACTION (BY BUSINESS AND INDUSTRY AND BY EDUCATION). (HH)

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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Proceedings of the

TECHNICIAN MANPOWER CONFERENCE

A Conference Concerning the Education and Utilization of Semi-Professional Technical Personnel

Sponsored by

THE UNIVERSITY OF WASHINGTON

Under the Auspices of

The Executive Office of the President of the United States
Office of Emergency Planning

October 23-24, 1963

University of Washington
Seattle

JC 670 824

FOREWARD

The increasing importance of the technician in business and industry has served to underscore the necessity of concerted and forward-looking action in the education and utilization of technical personnel. The University of Washington and the Office of Emergency Planning of the Executive Office of the President of the United States have endeavored to bring together representatives of interested organizations and agencies for the purpose of examining technical manpower needs in the Pacific Northwest. The following is a report of the presentations at the Technician Manpower Conference held at the University of Washington Campus, October 23 and 24, 1963.

The general plan of the conference was to consider the problems of technical manpower nationally, regionally, and locally in an attempt to focus upon possible action in providing solutions to these problems. Representatives of the federal and state government, regional and local industries and businesses, and of educational institutions were asked to make presentations concerning various aspects of technical manpower utilization and education. Two participants--one representing business and industry and one representing education--were asked to discuss action programs as the culminating activity of the conference. Ample time was provided for discussion and questions by all participants. Unfortunately space limitations make it impossible to report those portions of the proceedings.

Reports and comments of those who participated do indeed indicate that the conference did achieve its broad, general purpose--to provide direction for future activities concerning technical manpower needs and problems. I wish to acknowledge the contributions of the participants in the program and of each conferee who through his participation has helped to emphasize the significance of what may well be this nation's primary contemporary economic problem.

I commend the following report to your personal attention.

Frederic T. Giles
Professor of Higher Education
University of Washington
Conference Director

Table of Contents

Page

Address: NATIONAL TRENDS RELATED TO THE ROLE OF THE TECHNICIAN 1

William G. Torpey, Manpower Specialist, Office of Emergency Planning, Executive Office of the President of the United States

Address: NATIONAL EMPLOYMENT OUTLOOK FOR TECHNICIANS 11

Kenneth A. Brunner, Specialist for Associate Degree and Related Programs, United States Office of Education

Address: THE IMPORTANCE OF TECHNICIANS TO BUSINESS AND INDUSTRY IN THE NORTHWEST: AN EMPLOYER'S VIEW 23

Walter W. Straley, President, Pacific Northwest Bell Telephone Company

Panel Presentations:

Representing Industry 28

Peter C. Armentrout, Chief, Educational and Training Services, The Boeing Company

Representing Health Services 31

John R. Hogness, Associate Dean, School of Medicine, University of Washington

Representing Government 36

Lee Parker, Supervisor, Examination Section, Washington Department of Personnel

Address: EDUCATIONAL PROGRAMS FOR SUPPLYING TECHNICIANS 40

Athol R. Baily, Associate Professor of Industrial Education, University of Washington

Panel Presentations:

Representing Adult Education 46

Dean H. Goard, Assistant Director for Adult Education, Vancouver, B.C. School District

Representing Community Colleges 51

Dwight C. Baird, President, Clark College

Table of Contents
(Continued)

Page

Panel Presentations (Continued):

Representing State Colleges 54

P. H. Atteberry, Professor of Industrial Arts,
Western Washington State College

Representing Private Colleges 60

Thomas J. Killian, Assistant to the President for Science
and Engineering, Seattle University

Representing Vocational-Technical Institutes 62

Thomas J. Gilligan, Assistant Superintendent for Adult and
Vocational Education, Seattle Public Schools

Representing Universities 65

Joseph L. McCarthy, Dean, Graduate School, University
of Washington

Action Presentations:

WHAT CAN BUSINESS AND INDUSTRY DO? 67

Stanley Little, Director of Industrial Relations,
The Boeing Company

WHAT CAN EDUCATION DO? 71

Herman N. Miller, Assistant Superintendent for Vocational
Education, Washington Department of Public Instruction

Roster of Participants 75

NATIONAL TRENDS RELATED TO THE ROLE OF THE TECHNICIAN

William G. Torpey, Manpower Specialist
Office of Emergency Planning,
Executive Office of the President of the United States

The Office of Emergency Planning has the responsibility for directing and coordinating the development of peacetime readiness programs and emergency plans for the proper utilization and control of the manpower resources of the Nation under various emergency situations. To carry out this responsibility requires a manpower organization in place and ready, an adequate knowledge of our present and potential manpower supply and requirements, and action to eliminate or reduce present and foreseeable shortages of manpower. The utilization conference program action through responsible local groups and organizations to reduce or eliminate actual or potential shortages in scientific and technical manpower. Local utilization conferences held under the auspices of OEP--such as this conference here in Seattle--aim to induce the best productive effort on the part of scientific and technical personnel and improve the quality of the national manpower pool.

Another type of concern of the Office of Emergency Planning relates to a Comprehensive Program for the Emergency Management Resources in the event of nuclear attack. Under basic OEP guidance, states are setting up organizations for the purpose of establishing state-wide resource management programs. To assist states in establishing their plans, the OEP national office has recently prepared an Example State Plan which is an application of principles contained in an "Organization and Planning Guide for State and Local Emergency Management of Resources." States are being asked to work through the planning steps provided in the Guide and in the process examine action steps and documents illustrated in the Example Plan. In connection with individual state plans, some of you in this audience, because of your competency in technical manpower, may be invited in the future to participate in state and/or local manpower resource planning. My purpose at this moment is to alert you to the existence of the Comprehensive Plan and to solicit your cooperation, should you subsequently become involved in related state and/or local activity.

Conference Scope

The specific purposes of this conference are three-fold: (1) to bring present and prospective employers of technician personnel up-to-date on recent trends in the technician manpower field; (2) to permit an exchange of ideas on the subject of the education, training and use of technicians with the objective of stimulating self-analysis and subsequent appropriate action by individuals in your area and elsewhere having technician manpower responsibilities; and (3) to obtain comments and suggestions from conferees with respect to improving technician manpower education, training and use, on a nationwide basis.

The focus of this conference is technician personnel, in the sense, broader than the assistant to the scientist or to the engineer. However, the national concern for the role of technicians may be more clearly understood through a review of federal and international activities occurring during the past several months and involving the education and/or use of scientific and engineering manpower. Numberous opportunities for technicians within the scope of this conference are very intimately related to scientific and engineering personnel. The limitations of time today prevent any attempt on my part to present, even in outline form, all recent significant events bearing on this category of personnel. Nevertheless, from the parade of international and federal activities, I have selected a few to which I shall now direct your attention.

1. Significance of R&D in Our Economy

Statistics for last year show that funds for the performance of research and development by private industry totaled $11.6 billion. The amount of increase in 1962 over the previous year was 6% over the comparable total of $10.9 billion in 1961, and illustrates the continued expansion of industrial R&D activities characteristic of the past decade. Federally financed R&D performance by industry in 1962 totaled $6.7 billion; R&D performance financed by companies themselves amounted to $4.8 billion. It is estimated that funds for industrial R&D performance in 1963 are increasing over 1962.

With respect to the total funds for industrial research and development, for the aircraft and missiles and the electrical equipment and communication industries together accounted for 58% of the $11.6 billion total. These industries are closely associated with the nation's research and development program in the missile, aircraft, electronics and space exploration fields. Chemicals and allied products (10%), machinery (8%), and motor vehicles and other transportation equipment (7%) industries are the next ranking performers of research and development. Research in connection with professional and scientific instruments, rubber products, fabricated metal products, primary metals, petroleum refining and extraction, food and kindred products and paper and allied products accounts for most of the remaining funds. Some of these companies are located here in the Pacific Northwest.

Certain industries receive substantial amounts of federal funds for their research and development programs. For example, latest figures indicate that, in the aircraft and missiles industry, 56% of the total industrial research and development has been financed by federal funds; in the electrical equipment and communication industry, 24% of the total came from the Federal Government. On the other hand, some industries from their own resources are supporting increasing portions of the total performance of research and development; in 1962 five industries supplied company funds for more than 90% of their totals for research and development in their respective industries.

In the Federal Government, scientific and technical activities are carried on by many federal agencies. Currently, 37 out of 82 federal agencies are engaged, to some extent, in scientific or technical activities, resulting from their efforts to carry out their assigned missions. The functions performed may be specifically scientific or technical in nature or may require scientific or technical effort incidental to their performance. Some of the 37 agencies have elaborate organization structures to conduct their scientific or technical activities. Among these agencies there are varied R&D programs. Federal activity ranges from actual planning and administration of R&D work to the dissemination of the results of such work carried on by government or by others. It is estimated that the Federal Government is allocating a total of approximately $14.9 billion on R&D work alone during the current fiscal year.

The growing role of R&D in our economy sharply increases demands for technicians.

2. Defense Buildup

Defense preparations have been instituted as part of the buildup of our national strength. Recent aspects include:

1. additional appropriations for the Armed Forces.

2. authority to extend active duty tours of military personnel.

3. reactivation of ships and planes once headed for retirement.

Defense buildup efforts require greater use of scientific and technical skills, both in direct military activity as well as in certain civilian activity. Again, technicians play a key supporting role.

3. Space Goals

Pointing out that it is time for this nation to take a clearly leading role in space achievement, the President in 1961 requested Congress to provide funds, above and beyond increases he had earlier requested for space activities, to meet the following national goals: (1) before this decade is out, landing a man on the moon and returning him safely to the earth; the President said that no single space program will be so difficult or expensive to accomplish; this goal, for example, means accelerating the development of lunar space craft, the development of alternate liquid and solid fuel boosters, other engine development and unmanned explorations; (2) acceleration of the development of the ROVER nuclear rocket which gives promise of providing a means for ambitious exploration of space, "perhaps beyond the moon, perhaps to the very end of the solar system itself"; (3) acceleration of the use of space satellites for world-wide communications; (4) a satellite system for world-wide weather observation.

The President has commented that we are committed to seeing that the United States occupies an important position in efforts to penetrate the far reaches of space. Such a program involves a wide range of use of scientific and technical talent, including technicians as supporting personnel. As a matter of fact, NASA, in its own laboratories, currently employs more than 5,000 engineering technicians; the significance of this figure may be better understood when it is realized that approximately 85% of NASA funds are allocated to contractors. For the current fiscal year, Congress has authorized NASA to spend $5 billion.

The attainment of space goals stated by the President requires extensive research and development in almost every branch of science and technology at the frontiers of knowledge. New materials and components must be developed to function in the extreme cold and the extremely low pressures of outer space, and at extreme temperatures attained in rocket combustion chambers; new developments in propulsion, in electronics, in communications, in guidance and control techniques, are required. New knowledge and experience in the space sciences and technologies will provide a basis for its application for a variety of purposes. But technicians, as well as scientists and engineers, are needed now in greater numbers to work in the space program. Even greater needs are forecast for the future.

4. U. N. and O.E.C.D.

In the foreign field, attention must be given to the growing impact of two international organizations, the United Nations and the Organization for Economic Cooperation and Development, to which the United States belongs. Current programs of each organization have an impact upon American scientific and technical manpower.

The United Nations through its regular programs renders to member nations help which often involves the employment of technical skills. Related international groups like UNESCO do likewise. In addition to the help that international bodies give through their own regular annual budgets, the United Nations and eight international organizations in the United Nations family (such as the International Civil Aviation Organization, World Meteorological Organization and the International Atomic Energy Agency) share in funds available each year to operate jointly an expanded program of technical assistance. Technical assistance, given only at the request of individual governments, is provided through a variety of ways. One method is the sending of experts to less developed countries to help solve technical and economic problems involved in their development plans; some experts are technicians.

Another illustration of the increasing role of technical brainpower is action by the UN Economic and Social Council. At a recent session held in Geneva the Council noted the unique contribution which regional economic commissions can make toward the development of countries in their respective areas and initiated action to strengthen the ability of such commissions to help in technical assistance programs: the effect of this action was to increase the demand for specialized personnel for regional operations. The Council also has discussed the question of the application of science and technology to the needs of developing countries and convened a world-wide conference on this subject which was held in Geneva last February. In keeping with the general theme of the conference, special emphasis was given to techniques of development which can lead to optimal utilization of manpower, including the training of national personnel (in particular, cadres of scientists, engineers and technicians). Such a conference has given greater impetus to the utilization of technical personnel.

5. The Peace Corps

The Peace Corps represents a pool of trained American men and women sent overseas by the U.S. Government or through private organizations and institutions to help foreign countries meet their urgent needs for skilled manpower. This organization differs from other types of assistance abroad in that its members supplement technical advisors by offering specific skills needed by developing nations which aim to put technical advice to work: Peace Corpsmen; help provide the skilled manpower necessary to carry out development projects planned by the host governments acting at a working level.

On the basis of operating experience with the pilot program established by Presidential Order, legislation was passed last year to provide statutory authority to build a long range Peace Corps program. Presently, the Peace Corps has approximately 5,000 members in 45 countries; it is expected that next year there will be approximately 9,000 members in 50 nations.

At the present time the Peace Corps is experiencing shortages of applications from persons qualified in several occupational areas, including certain types of technicians. As requests from developing countries continue to be made and as recruiting efforts of the Peace Corps are accelerated, larger numbers of individuals with technician training will find a challenge in such overseas activity. The Peace Corps need for technicians exemplifies the trend toward widening opportunities abroad for Americans with technician skills.

6. Selected National Actions of a Broad Nature

A comprehensive national analysis of scientific and technical manpower--including technician manpower--was initiated in 1956 when the President appointed his Committee on Scientists and Engineers as an action group to coordinate and stimulate the nation's efforts to meet the shortage of scientific and technical manpower. During its existence 1956-1958, the Committee focused attention on a variety of manpower problems and was instrumental in stimulating "follow-through" action related to the education and utilization to technician manpower. Examples of activity traceable to the work of the Committee were the passage of the National Defense Education Act, revision of the Dictionary of Occupational Titles by the Department of Labor to include a current concept of technician duties, publication and dissemination by the Committee of a pamphlet (30,000 copies) explaining possible courses of action to enhance the education and utilization of technicians, and sustained emphasis on the role of technicians through a series of technical manpower conferences held throughout the United States since 1957, first under the auspices of the President's Committee and now of OEP. This conference here in Seattle is the latest example of such a conference.

In 1962 the President requested his Science Advisory Committee to examine the nation's scientific and technical manpower resources to determine the quantity and quality required to meet future needs. A Manpower Panel was appointed by the Chairman of the Committee to analyze the manpower problem and to submit recommendations for an action program to the Committee. The Panel, and subsequently the Committee, focused attention on the role of scientific and technical personnel in connection with national activities and commented in its first report issued in December 1962 that remedial efforts are best concentrated in three related strategies, one of which is an increase in the number of qualified technicians and the use of such technicians more effectively. The Committee stated that technicians in all fields of science and technology can conserve professional skills and thus enhance total manpower resources. The subject of technicians is currently under study by the Committee and will be the subject of a forthcoming Committee report.

Other actions related to the education and utilization of technicians, but independent of the Federal Government, include the establishment of an institute by the National Society of Professional Engineers to certify engineering technicians; the publication by an ASEE Technical Institute Evaluation Working Committee of quality standards for use as guidelines for constructing, improving and evaluating engineering technology curricula, and accelerated efforts on the part of the Engineer's Council for Professional Development to inspect and accredit technician education curricula.

7. Legislative Interest

Currently, four of several pending legislative bills--the National Education Improvement Act of 1963, the Technical Education Act of 1963 and the Higher Education Facilities Act of 1963 and the Vocational Educational Act of 1963--have a direct bearing on the theme of this conference:

(1) H.R. Bill 3000, known as the National Education Improvement Act of 1963, is the comprehensive education program recommended to the Congress by the President last January. Title II of the bill, for example, provides for expansion and improvement of college level technical education: in order to increase the supply of engineering and other semi-professional technicians critically needed in industry, government, research, teaching, health services and other essential fields, this Title would authorize to be appropriated, for grants to assist in the establishment, expansion or improvement of college level programs of technical education, $20 million for the fiscal year ending June 30, 1964 and such sums for each of the next six fiscal years as the Congress may determine. Grants would be made to educational institutions for projects for establishing a new college level program of technical education or for expanding the enrollment capacity of, or for improving, an existing college level program of technical education (including grants for projects for construction or equipment of instructional and related facilities). The term "college level program of technical education" is defined, in part, as a program of full-time college level instruction, or its equivalent, of two years duration in an organized occupational curriculum in engineering technology, mathematics, or the physical or the biological sciences and which is designed to prepare the student for immediate employment at the semi-professional level in engineering, scientific or other technological fields that require understanding and application of basic engineering, scientific or mathematical principles or knowledge.

Hearings have already been held on this bill.

(2) H.R. Bill 446, known as the Technical Education Act of 1963 (originally introduced in 1962), would provide federal assistance for the establishment, expansion and improvement of programs of technical education at the college level. One set of purposes of the bill would be (1) to assist the states to make inventories to determine the nature and scope of existing programs of technical education (consisting of organized occupational curriculum in engineering, mathematics or the physical or biological science which require not less than two years of full-time college level study or its equivalent and are intended to

prepare the student for immediate employment at the semi-professional level); (2) to survey technical manpower requirements for semi-professional technicians; and (3) to develop state plans for the expansion, establishment and improvement of programs of technical education. In order to carry out these particular purposes, $2 million would be authorized to be appropriated. Furthermore, the bill would also assist in the establishment, expansion or improvement of programs of technical education in accordance with state plans.

This bill is currently pending in the House Education and Labor Committee.

(3) H.R. Bill 6143, known as the Higher Education Facilities Act of 1963, would authorize assistance to public and non-profit institutions in financing the construction, rehabilitation or improvement of needed academic and related facilities in undergraduate and graduate institutes. Title I of the bill provides for grants for the construction of under-graduate academic facilities. There would be authorized to be appropriated $230 million for the fiscal year ending June 30, 1964 and each of two succeeding fiscal years; for the fiscal year ending June 30, 1967 and the succeeding fiscal year only, such sums would be appropriated as Congress might hereafter authorize by law. Any state desiring to participate in the grant program under this Title would designate a state agency broadly representative of the public and of institutions of higher education (including junior colleges and technical institutes) for this purpose. Each state plan will include, among other items, provision that not less than 22% of the funds allotted for any year to the state would be available only for use for the construction of academic facilities of junior colleges and technical institutes. By definition, the term "junior colleges and technical institutes" would mean institutions of higher education organized and administered principally to provide (1) a two-year program which is acceptable for full credit toward a bachelor's degree or (2) a two-year program in engineering, mathematics, or the physical or biological sciences which is designed to prepare the student to work as a technician and at a semi-professional level in engineering, scientific, or other technical fields which require the understanding and application of basic engineering, scientific, or mathematical principles. An institution would be eligible for a grant for construction of an academic facility under this Title only if such construction would (1) result in an urgently needed substantial expansion of the institution's student enrollment capacity or (2) in the case of a new institution of a higher education result in creating urgently needed enrollment capacity.

Title III of the bill provides for loans for construction of academic facilities. Under this Title, $120 million would be authorized to be appropriated for the fiscal year ending June 30, 1964 and each of two succeeding fiscal years. A loan pursuant to this Title would be repaid within a period not exceeding 50 years.

This bill was passed by the House of Representatives on August 14 and is now awaiting action in the Senate Committee on Labor and Public Welfare.

(4) H.R. 4955, known as the Vocational Education Act of 1963, would authorize federal grants to states to assist them to maintain, extend, and improve existing programs of vocational education, and to develop new programs of vocational education, so that persons of all ages, in all communities of a state would have ready access to high quality, vocational training or retraining. The term "vocational education," as used in the bill would mean vocational or technical training or retraining which is given under public supervision and control or under contract with the state board or local education agency and is conducted as part of a program designed to fit individuals for gainful employment as skilled workers or technicians in recognized occupations (excluding any program to fit individuals for employment in occupations generally considered professional or as requiring a baccalaureate or higher degree); such term would include vocational guidance and counseling in connection with such training, the in-service training of teachers, supervisors and directors for such training, travel of students and vocational education personnel and the acquisition and maintenance and repair of instructional supplies, teaching aids and equipment (but would not include the construction or initial equipment of buildings or the acquisition or rental of land). For the purpose of making grants, sums would be authorized to be appropriated, ranging from $45 million for the fiscal year ending June 1964 to $180 million for each fiscal year after June 30, 1967. An Advisory Committee on Vocational Education would advise the U.S. Commissioner on Education in the preparation of general regulations and with respect to policy matters arising in the administration of the act.

This bill was passed by the House of Representatives on August 6; a similar (but not identical) bill was passed by the Senate on October 8.

Although, at this point in time, full Congressional action has not yet been taken on these bills, they represent keen legislative interest in the problem of technical personnel.

Some Conference Issues

Current consideration of the question of the education and utilization of technicians raises a series of issues, several of which will be discussed during the course of this conference and answers to which are needed before final decisions are made in this area of specialized manpower. These issues include such questions as: Is there a need for a federal program to improve the quantity and quality of technicians developed through two-year college level education programs, paralleling the program for vocationally-oriented technicians established through Title VIII of the National Defense Education Act? If a new federal program is needed, what types of federal grants should be incorporated--grants for construction or for equipment or for faculty development or for other objectives or for a combination of these objectives? How long a time range should be included in a federal plan--five years, the decade? Should federal funds be distributed through a single state agency or directly through individual educational institutions which submit useful educational plans? What is the role of the junior and community college in technician education? Should federal funds available for agricultural vocational education be also made available for use in educational programs oriented toward agricultural technical or other technical pursuits? The foregoing are representative of questions, answers to which may be developed through the medium of this conference.

Your Role in This Conference

The ultimate purpose of this conference is to stimulate action. Therefore, the end of consideration of the problem of the conference cannot come with the adjournment of the final session. The real evaluation of this conference will depend specifically on collective and individual follow-up action after the conference.

To you as individual conferees, I urge that you give careful consideration to the total suggestions to be made by all of the speakers; to the extent that individual suggestions may apply to your own situation or to that of your organization, I recommend that you consider implementation of such suggestions as you deem appropriate.

An example of what every individual present today can do, as part of his follow-through responsibilities from this conference, is to take positive steps, as he sees opportunity, to dispel the misunderstanding which currently surrounds the concept of the technician. Misunderstanding on the part of some parents, students, counselors, employers and educators, among other groups, contributes to the problem of lack of status for this part of the educational system and for the graduate of a collegiate level technical program. Contrary to what one collegiate official said from a public platform in Ohio recently, the graduate of a two-year college level technician program is not, and must not be considered, a second class citizen. As employers, union officials, educators, professional and technical society members and government personnel, working together, we must employ methods at our disposal to promote public understanding of the technician--his education and role in employment.

To you who have been conference planners,I urge the following steps:

- Publication and dissemination of the conference proceedings as quickly as possible.

- Sending to each conferee a follow-up questionnaire designed to elicit conferees reactions.

- Critical review and analysis of the total suggestions made and problem areas cited by the conferees.

- Calling together, in the near future, of a small number of participants of this conference, representatives of the basic groups involved, for the purposes of (a) pooling their analyses of total positive suggestions made and problem areas cited; (b) reviewing, collectively, the general extent of "follow through" actions accomplished, as evidenced by the executed questionnaires and otherwise, and (c) designating responsibility for further implementation of appropriate items.

The planners of this conference have provided an excellent array of speakers. In terms of the nation's needs, this is an historic gathering. On behalf of my Office, I offer congratulations to the conference sponsor, the University of Washington--and particularly to Professor Fred Giles, for the team efforts which have made this conference possible. May I extend to you, the audience, every wish for real success for a useful meeting today and tomorrow, and for a significant degree of subsequent constructive, follow-up action on the part of us all.

NATIONAL EMPLOYMENT OUTLOOK FOR TECHNICIANS

by

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U.S. Department of Health, Education, and Welfare
Washington, D. C.

Mr. Chairman, ladies and gentlemen:

You honor me by permitting me to participate in this conference. Thank you. You challenge me, too, by the topic you have asked me to discuss with you this morning. Thank you for that, too. It is good to be challenged. It helps us to make that extra effort that is needed to keep us growing, vital, and alive.

That extra effort is needed today if our Nation and this region are to attain the new levels of quality in their pools of technical manpower, higher and unrelenting levels of quality compelled by the critical times in which we live. We face a difficult task, but not an insurmountable one. It can be made easier, and I feel sure it will be made easier, by cooperative efforts of the many segments of our society which we represent: government (National,State, and local); education (university, junior college, secondary, technical, and vocational); business, and industry.

SOME DEFINITIONS

Originally I had planned to spend a few moments on some definitions, but Dr. Giles has already covered the area very well, so I am skipping over that part of my prepared remarks. To make clear the focus of what I have to say, however, I will read to you the definition of technical education which appears in Florida's State Department of Education Bulletin 79H-1, entitled Evaluative Instrument for Technical Education in Florida's Community Junior Colleges. It reads as follows:

> "Technical education is concerned with development of the individual who is sufficiently versed and competent in scientific principles, theories, and practices that he can make direct applications of them in his role as an aide to the scientist or engineer in industrial research and production. The distinguishing feature of technical education is that the program is concerned with development of individuals whose knowledge of theory and principles carries them beyond the skilled craftsman role in their facility for creative and versatile applications of their special talents."

You may wonder, and rightfully so, why I am not quoting from a publication of a Northwest State. I should think there is an equally apt definition of "technical education" in one or more of them. Fact is, though, I did not find one.

Let me tell you of some things I did find. One of them particularly interested me. In Technical Education; Annotated Bibliography, prepared by Washington's State Board of Vocational Education, some 346 books, pamphlets and published papers are annotated. Some of the annotations contain over 100 words of information, including one which describes a 5-page publication of the U.S. Office of Education. But the one which really caught my eye was this description of another Office of Education publication, "Defines technical education." That was the 3-word annotation for Organized Occupational Curriculums, a 250-page publication which I co-authored with the former Director of Junior College Education in Washington State, Dr. D. Grant Morrison. You know, I was not sure how I should take that annotation, but I feel somehow flattered by it. So does Grant. It's just that we are a little uncomfortable with the thought that we took 250 pages to define the term.

Another of your publications, Technical Education in Washington State, gives some details about types of technical education programs--two-year, day-preparatory programs and evening-adult and extension programs--and these details are useful. They point out that the programs are employment-centered, that they vary from five to six hours of class and laboratory work in school with several additional hours of study, and that approximately one-half of the time is spent studying theoretical and practical information directly concerned with the technical specialty, 30 percent of the time is devoted to the basic background subjects of mathematics, chemistry, physics, and English, and 20 percent is divided between industrial relation subjects and electives. Mainly, however, this pamphlet describes technical education in terms of the kinds of education which prepares people to work as technicians.

There are many definitions of "technician," as Dr. Giles pointed out, but this conference is concerned in general with the kinds of workers described in this fine pamphlet.

Generally, in my daily activities for the U. S. Office of Education, I am most concerned with that technical education which occurs in institutions of higher education, public and private, and which has as its goals and purposes those which I quoted earlier, and which usually leads to the award of an associate degree, from a junior college or technical institute, or a certificate or diploma from a 4-year college or university. Graduates from such programs are usually employed as engineering or scientific technicians.

You probably know that it was the President's Committee on Scientists and Engineers which started this series of manpower utilization conferences in 1957, a program considered to be so vital and essential that the Office of Emergency Planning has been continuing it as one of its major activities. The President's Committee on Scientists and Engineers made a number of other valuable contributions toward solving the rapidly developing scientific and technical manpower needs in the sixties. Let me just mention one or two.

It adopted a definition of "technician" which we continue to use in the survey of organized occupational curriculums. Further, to give a better focus to the work of a technician the Committee reported the following personal requirements after one year on the job: (1) enough scientific and engineering knowledge to be able to carry through simple analyses, independently, in at least one special field, (2) ability to apply college algebra, analytical geometry, trigonometry and logarithms, (3) ability to prepare a variety of simple plans, diagrams, and codes, and (4) ability to associate new ideas and developments with new technical problems. In its final report, the Committee urged more widespread utilization of technicians at the same time recognizing that less than one-sixth of the required number were graduating from accredited or approved programs (12:24) 1/

1/ The first set of figures refers to the reference designated by that number in the selected bibliography distributed to the audience; the second to specific page numbers in that source.

I am concerned about these kinds of workers when I consider the employment outlook for technicians and what higher education is doing now, and should be doing soon, in order to meet the projected needs for technicians in industry and government.

WHAT THE FUTURE HOLDS

Just as there is more than one definition for technician, there is more than one source for the kinds of information you have asked me to present. Guesses about the future have been rampant. Projections are what we term the more educated guesses. But, they still are guesses. They must be. We can project only on the basis of what we know, about what exists. The reasons these projections don't turn out exactly the way they should can be many and complex. Some are simple, as simple as the introduction of one new element into the situation. Then the projections have to be revised. And what makes it tough is we don't always recognize the new elements when they are first introduced. Let me give you an example totally unrelated to the conference theme. Why have women's enrollments in higher education been climbing at a more rapid rate recently than those of men? Is it just because that's (pause) where the boys are? Or is it something else we might have noticed sooner, related to going to college practices of women, and raised our projections accordingly? What happens if a man can't get a room in a dormitory? He stays in approved rooms. What about women? Same thing, but not to the same degree. More of them don't go to college if they don't get a room in a dormitory. Recently women's dormitory constructions have been at a high level (cause). Recently women's enrollments have been at a high level (effect). Possibly; possibly not. I'm no expert. Just used it to illustrate that a forgotten or overlooked element will lead to a faulty projection.

Combinations of the same elements, but in different ways, also lead to varying projections, even by the same experts. I am hardly a manpower expert, but through education, developing the needed manpower--at least one level of manpower, the technician and semiprofessional worker--is my concern. So I am vitally interested in learning all there is to know about the future needs for the graduates of associate degree and similar programs in higher education.

Some of what I hear and read disturbs me because it just does not seem possible to meet the projected needs. We don't appear to be tooling up fast enough, combining enough of our resources, to produce technicians of the quality we need and in the quantity we need by 1970.

On the other hand some of what I hear and read disturbs me for almost the opposite reason. You remember that the 1963 convention of the American Association of Junior Colleges was held in Seattle in March. At these meetings heavy stress was laid on the technical education needs to be met by junior colleges. After one of the panel discussions, one of the more vigorous and dynamic Florida junior college presidents asked me, "What's all this I've been hearing about a need for technicians? I have a fine physical plant, the best equipment, excellent faculty, but I can't get any students. At least not enough to justify all the trouble we've gone to." He went on to say that he feared that industry in his community had over sold him on their needs. In 1957 representatives from two large firms had gone all over the Southeast recruiting junior college and technical institute graduates, even dropouts from bachelor degree programs. The junior college president was impressed by this, but still he did not rush into a new curriculum. First, he made a careful community survey to confirm the need for technician programs. Then he got the State and the Federal Government to provide some of the funds, got new faculty, and soon was open for business. But in 1961 and 1962 the big recruiters were not coming around any more, not even to the hometown community college. The job placement director at the junior college had no more requests from them for technicians. Naturally, the word got out, so the students, rather than commit themselves to training for technician jobs which were no longer available, are taking pre-engineering, pre-math, or pre-science curriculums for the glamour jobs with the space agency, NASA, and supporting civilian firms. What could I say? Perhaps you have not been faced with the same problem in the Northwest. Maybe you have, to a lesser degree. What do you say? Probably we all would recognize that this is just a temporary lull. Such short-run situations are bound to develop in free economy. The long-range pictures, though, these are the most exciting and challenging.

A few years ago the U. S. Department of Labor widely distributed a pamphlet, Manpower: Challenge of the 1960's. The predictions in this publication are probably fairly well known by most of you. Just the same, I will make a few summaries from it (3:10-11):

> During the past decade, professional, office and sales workers as a group exceeded for the first time in our history the number of persons employed in manual occupations (skilled, semi-skilled and unskilled jobs).

During the coming decade, this trend will continue. The fastest growth will occur among professional and technical occupations, especially engineers, scientists and technicians.

Among the manual occupations, the need for skilled craftsmen will increase, but the number of unskilled jobs will stay about the same, continuing their long-term relative decline.

And the biggest increases will occur in occupations requiring the most education and training

especially in the professional and technical occupational group. This occupation group will increase by 40 percent in the 1960's. Of significance to education is the fact that those working in this group in 1959 had completed an average of 16.2 years of school. The average years of school completed of those working in 1959 in two other groups--proprietors and managers; clerical and sales--amounted to more than twelve years; and there will be from 22 to 25 percent more people in those occupations in 1970 than in 1960. It should be kept in mind that the whole labor force is expected to increase 20 percent between 1960 and 1970. Thus, the 40 percent increase in the professional and technical occupation groups is even more significant. Included in this somewhat heterogeneous category are the most highly educated members of our population as well as professional baseball players and popular entertainers, some of whom we would today call "drop outs." In other words, they got where they are without even achieving a high school diploma. Technicians are in this group, too, although specific data on them do not appear in the forecasts. However, on several occasions Department of Labor personnel have commented directly on the developing needs for technicians. I will mention several of them.

Two years ago I participated in a conference on "The Emerging Role of the Engineering Technician" at the University of Dayton. It was the first one held under the auspices of the Executive Office of the President which was devoted exclusively to technician utilization. Harold Goldstein, Chief of the Department of Labor's Division of Manpower and Employment Statistics, commented at that 1961 conference about technical manpower requirements in this decade. First he referred to the 40 percent rate of increase for professional and technical workers in the 1960's, double the rate of growth of the whole labor force. Then he said the rate of growth in engineering and technical occupations generally may be double that, or 80 percent. To summarize, Mr. Goldstein said that technician jobs are expected to increase four times faster than the average rate of employment increase in this decade.

Recently the U. S. Department of Labor released another publication, its widely used Occupational Outlook Handbook (22). In it, too, they identified technicians as one of the fastest growing occupational groups and reported all indications were that the situation would continue. Research, development, design, and other work which must precede the manufacturing process will call for increasing numbers of technicians to assist engineers in production planning, in technical sales work, and in maintaining liaison between the production and the engineering departments. Of course, should there be a substantial cut in the defense program or if the level of business activity falls off sharply and over a prolonged period, there would be less demand for technicians and more competition for the available jobs. (Probably the biggest competition would come from displaced engineers.) But the opposite seems to be developing.

We are already beginning to feel the short-run effects of our accelerated space program. Some published estimates of the costs of new or accelerated space programs, including the proposed manned lunar landing, are 5 to 6 billion dollars a year by 1970. Comparative 1962 estimates were 1.3 billion dollars. What effect could this increase in proposed activities of only one government agency have on projected technician needs? In a talk at the technician manpower conference held at the Dearborn campus of the University of Michigan a few months ago, Bernard Michael of the Bureau of Labor Statistics, U. S. Department of Labor, offered this answer:

> Translated roughly into requirements for technical personnel, an increase of 4.7 billion could mean an increase of nearly 100,000 engineers and scientists and possibly 70,000 semi-professional workers between now and 1970 for this program alone.

Furthermore, the need peak would occur within 3 to 5 years; it would not be spread out over the decade. At the very least this one agency alone, if given the total estimated funds to accelerate its program, would require 14,000 technicians and other semiprofessional workers each year through 1968. The emphasis, of course, would be on technicians who would work directly with space scientists and engineers.

In Congressional subcommittee hearings last year, the honorable Willard Wirtz, then Under Secretary of Labor, referred to the expected heavy needs of the space program for highly trained personnel. He also told of the confusing complex of heavy unemployment, part of it due to job displacement because of rapid technological change, and at the same time the tens of thousands of jobs which could not be filled by the United States Employment Service. The greatest number of openings were in jobs requiring the greatest amount of education. Mr. Wirtz then reported what are generally regarded as conservative estimates that we will need 78,000 new technicians each year through 1970.

I refer to the estimate as conservative because it is based on the same ratio of technicians to scientists and engineers as we had in 1960, approximately 73 per 100. Most authorities think that ratio should change and many are working to get it changed by getting education to prepare more technicians and by getting government and industry to employ more of them. Dr. Lynn A. Emerson used a 2 to 1 ratio of technicians to engineers in a report to the Panel of Consultants on Vocational Education and projected an annual need of 200,000 technicians in the decade ahead (29:36). A comparison of 1962 job openings reported by the Department of Labor is indicative of the direction of the comparative demands for scientists, engineers, and technicians. All three indicated increased job openings over the previous year of, respectively, 60 percent, 40 percent and 300 percent (23:2).

Where are they all coming from? In the report already referred to, Dr. Emerson analyzed in some detail the various technician preparation programs or sources now being used and then estimated the number of technicians to be supplied by them, each year during the next ten years, as follows: (29:151)

On-the-job training and in-plant training programs	36,000
Armed forces technical schools	10,000
Engineering college graduates (underemployed, but in most cases only for a year or two) and drop-outs	13,000
Organized technical training programs in public and private educational institutions	141,000
Total	200,000

The heaviest load and the largest increase over the present fall on the organized educational programs to prepare technicians, as indeed they should.

Dr. Emerson recognized that some of these 141,000 technician graduates would be expected to come from high school programs, others from area vocational-technical schools, technical institutes and technical institute division of engineering colleges, but he indicated that "the *community college* appears to be the most promising agency for nation-wide large-scale expansion of technical training" (29:163).

Just how much they must expand is clear from an analysis of enrollments and graduates in engineering-related organized occupational curriculums. The most recent data which are available in sufficient detail for analysis are for enrollments in the fall of 1960 and graduates between July 1, 1959 and June 30, 1960. Less than 16,000 graduates were reported that year by the 300 higher educational institutions which prepare technicians. Of these, 3,200--only one in five--were from 162 public junior colleges. If I understand Dr. Emerson's recommendations, public junior colleges should be preparing to graduate 60,000 annually within the next few years. It is apparent that they will have to make a tremendous effort to approach this quota. At first blush, it also appears that they will have to reverse a trend in the other direction. We note that for the first year of the survey of organized occupational curriculums, i.e., July 1, 1955 through June 30, 1956, almost 12,000 technician graduates were reported by 202 higher institutions, of which 3,800--almost one in three--were from 115 public junior colleges. Can we conclude that the public junior colleges have been doing a decreasingly adequate job of training technicians? It would seem so. Here, again, we must take a hard look at the data before jumping swiftly to any conclusion.

In most States we find public junior colleges graduated more technicians in the fifth than in the first survey year. Exceptions are Idaho, where one of two junior colleges discontinued these programs; Texas, where one of the larger public junior colleges changed its status to that of a liberal arts college; New York--and this was one of the big causes of the apparent decline of productivity of public junior colleges--where nine of the higher institutions which graduated 1,421 technicians were classified as public junior colleges in 1956, but were reclassified as technical institutes or semiprofessional schools by 1960, in which year they reported 1,621 technician graduates; Oregon, where Oregon Technical Institute with 223 technician graduates was classified as a public junior college in 1956 and with 229 technician graduates was identified as a technical institute by 1960; and, surprisingly, Washington, which in 1955-56 had 189 technician graduates from four public junior colleges, but in 1959-60 reported 124 such graduates from seven public junior colleges.

Still, when we look at the data from institutions classified as public junior colleges in 1956 as well as 1960, we find that the public junior colleges graduated 50 percent more technicians in 1959-60 than in 1955-56, whereas the total number of technicians prepared by all institutions of higher education increased only about 33 percent. So apparently the trend is in the right direction, except in Washington, but it should be moving much more rapidly.

Early in these remarks, I referred to a comment by the President's Committee on Scientists and Engineers that only one-sixth of the needed technicians were being graduated from approved technician programs, that is, those accredited by the Engineers' Council for Professional Development. Only one Northwest institution has ECPD accreditation, Oregon Technical Institute. But when we look at the total output of technicians--not just those graduated from ECPD-accredited curriculums--and find that 16,000 are graduating annually against a need of five time that number, it is clear that a significant gap still needs to be closed.

The future demand for technicians will probably remain strong in many specializations and at varying levels of skill and responsibility. The marked expansions in data processing, computer programming, electronics, highway building, aerospace, and the atomic energy field should provide especially attractive opportunities for technicians and serious challenges to educators and the users of the products of all types of educational programs for technicians, those who will employ technicians in increasing numbers in this decade.

Certainly all of us here realize the tasks ahead are of even greater magnitude than those of the past. Higher educational institutions will have to prepare five to six times as many technicians between 1966 and 1970 as they prepared a decade earlier. Industry will have to utilize engineering technicians more effectively, freeing engineers and scientists for tasks at higher levels. All levels of government will have to give greater encouragement and recognition to technicians in the occupational structure, probably by continuing, stimulating, and expanding conferences such as this one.

Let me congratulate the University of Washington on the leadership it has demonstrated by sponsoring this conference. With the wholehearted cooperation of industry, education and government, the rapidly growing needs for technicians can be met effectively. As I said in my opening remarks, it will be a difficult job, but not an insurmountable one, if we all pull together.

Thank you.

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THE IMPORTANCE OF TECHNICIANS TO BUSINESS AND INDUSTRY IN THE NORTHWEST: AN EMPLOYER'S VIEW

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About all I can say for these prospective remarks is that they come under an imposing title -- "The Importance of Technicians to Business and Industry in the Northwest: An Employer's View."

Actually, I have just two things to say, neither of which is in my mind much of a contribution either to my own enlightenment or yours, but they may help us to proceed with what I believe to be a proper flavoring of uncertainty as we approach the problem of the technician in our economy and society. To my academic friends it may be apropos to add that this may aid you in accepting my views, for I have heard it said that education is man's going forward from cocksure ignorance to thoughtful uncertainty. And thus, I am taking an educator's point of view.

My first point fits, I think, suitably under the subheading of: Man Refuses to Act Like a Statistic. And it's supported by the fact of my assumption that you join me in the difficulty of defining the term "technician," in a conference which indeed is scheduled to conclude with an attack upon the question of what can business, industry and education do about this indefinable and necessarily human object of our attention. From the Dictionary of Occupational Titles, I quote one definition of technical employment:

> ". . . occupations concerned with the theoretical or practical aspects of fields of endeavor that require rather extensive education or practical experience, or a combination of such education and experience for the proper performance of the work; such fields of endeavor, however, are less demanding with respect to background or the need for initiative or judgment in dealing with complicated work situations than those fields which are considered as 'professional.' These occupations are typically confined to relatively restricted fields of activity, many of them being concerned with the technical or mechanical details of the broader and possibly more theoretical fields of endeavor."

Now if you find that somewhat less than satisfyingly definitive, I would like to help by offering some samples of technician occupations from the Dictionary of Occupational Titles. Here are just a few:

Ferry Pilot . . . Flying Instructor . . . Hand Etcher . . . Tattoo Artist . . . Dental Technician . . . Radiotelephone Operator . . . Strip-Tease Artist . . . Bottom-Hole-Temperature-Survey Service Operator . . . Chorus Girl . . . Oyster Culturist . . . and Snake Tamer.

In another book that lists technicians, this one formally categorizing them in branches, I find 417 titles including, to me at least, the esoteric field represented by Insemination Technician.

All I am trying to say is that I am unable to get hold of a satisfying definition, and about all I can deduce is that there are certain people who are called technicians, and they hold many and varied jobs. It is relevant, I believe, and equally obvious that the list ought to be brought up to date every day. For though I did not search all the way through the Dictionary of Occupational Titles, the necessity of making additions is so great that I doubt our ability to maintain an adequate process of elimination, and I would not have been too surprised to have found a technical title -- "Rider, Express, Pony."

Now for a few statistics: Of the 728,474 men in the State of Washington civilian labor force, according to the 1960 census data there were 6.2% of them unemployed. As of that time, 45% of the unemployed were in categories which would normally be included under technicians -- the categories in census language of "craftsmen and operatives." In short, 45% of the male technicians were unemployed. Because I do not have an up-to-date study, will you allow me the assumption that something in this order of ratios might still hold in current male unemployment which, of course, shares the bulk of the statistical unemployment burden with common labor unemployed.

We are all quite aware that in the Puget Sound area there has in the past year been a drop in the demand for skilled or technical workers. Nonetheless, in the Seattle Times and the Post Intelligencer of September 22, 1963, there were 29 advertisements for professional and management people, there were 50 advertisements for skilled workers in various categories, and of course, out of the 133 advertisements for what is loosely called clerical and sales workers, many were seeking specific skills which would fit varying definitions of technicians or technical employment. All I am attempting to point out is the obvious -- there is no lack of need for the skilled technician; the need, of course, is to match the skills required with those who have them.

Over the next few years it is likely that jobs for unskilled laborers will stay at about the same level. I believe that jobs for farm workers undoubtedly will decrease, perhaps as much as 20%. Jobs, however, for the skilled worker, who may well be the technician we here concern ourselves with, will stay on the increase -- perhaps as much as an increase of 40% over the next three to five years. In fact, it now seems likely that five years hence, for every seven skilled jobs available there may be only about five skilled people trained to perform them. What I am saying is that the primary need is to get the quantitative statistic (inseparably associated with the use of technician) out of any category whatsoever except that of a human being who is somehow having trouble fitting the pattern of technological change. I quote from "The Annals of The American Academy of Policital and Social Science," March 1962:

"The central facts are simply that very rapid change is taking place and that we are going to have to adapt to it. It would be irresponsible for any of us to pretend that unemployment will not occur; it is even more irresponsible to assume that society is incapable of meeting such a challenge. The task is complex but deserves attention and action."

When one speaks of the future role of the technician, which essentially, I suppose, is that of supporting a shifting technology, one faces the obligation of developing plans based upon uncertainty and recognizing an essential barrier in the very fact that the technology, even through the mouths of scientists, governmental experts, businessmen, or industrialists, does not communicate its future as rapidly and as helpfully as any of us might like. It is not only likely, I would assume it to be a foregone conclusion, that satellite communications, for example, will bring us ultimately to the stage where our need for a universal language will be so clear that we will be forced to make our choice among the Mandarin, English, Russian, or even an invented language for everyone on earth. How many millions of technicians will be required just to get this teaching job accomplished? As Englishman observer Arthur Clarke has said, and it is of course true, it is now possible to place in memory storage every written expression of mankind since he first started carving on rocks into an electronic storage space of less than six cubic feet. Who will build this electronic library as a repository of all man's knowledge? Who will design and build and maintain the equipment whereby, by dialing some numbers or punching some buttons, any part of it at any time will be available to our children or grandchildren?

It is relatively useless to speak of the past, for we know the occupational impact of such things as the typewriter. In my own business we recognize that with the passing of panel and step-by-step switching equipment and the advent of what we call "crossbar," the man who is still described as "switchman" has left the realm of the mechanic and has become, of necessity, a workman trained in electrical knowledge. We are quite aware that the girl who sat and sits at the calculating machine adding long distance statements is disappearing, but in some instances reappearing in the completely new vocational role of machine programer.

But the reason I think this conference is important is that I believe it is addressing itself, under the uncertainty of the shape of technological advance, to the question of adjusting anything and everything, including the machine if this be required, for the welfare of man himself. All I want to be certain of is that we do not as part of this effort attempt to devise another machine to solve this problem, for it is Arthur Clarke again who reminds us of the Persian legend of the prince who, upon the death of his beloved bride, began the lifetime project of building about her sarcophagus the greatest temple in the world, adding by the decade the towers, the minarets, the marble, the alabaster, which always to his eye fell short of perfection until at last as an aged man he said to his architect, "I now see what is wrong with the whole thing. Get that sarcophagus out of there." We must use the machine as our servant, lest there come a time when only machines can talk to machines and we may tiptoe away and leave them to it.

In the process of matching our need for technical assistance, whether we call them technicians, skilled workers, or something else, a great deal of activity is under way. Some of it is in the schools. Seattle, to my mind, at least, at Edison High has a fine vocational program, some of which qualifies skilled people. Much more quantitatively is going on inside companies where, as usual, initial and retraining is being done to match the shifting technology, and of course government training is increasing. As

I understand it, thus far there have been 25 government training projects in Washington, and out of 1800 trainees thus far, 82% are gainfully employed.

But clearly, whatever programs evolve, they must be as flexible, as mobile, as responsive to change, and as intelligent as the individual worker himself must be to support the advancing technology. It does no good to train sub-assemblers where the need for them is rapidly diminishing. There must be more communication of the kind hopefully going on at this conference, but hopefully too in a more workaday pattern, where business, education, government, locale by locale, inventories shifting requirements and adapts flexible, imaginative, innovating kinds of training to meet the requirements. There ought, I think, to be more efforts such as those in the Western Electric Company where, in at least one city, the high school system does its training inside the Western Electric plant.

To conclude my first point -- man, including the technician, is not a statistic. We, at least in business, need an essentially humanistic point of view which will, I believe, match well a shareowner or capitalist point of view; that we enter with you into full partnership in an effort to look at our own needs, to keep you up to date with them, to consider the unskilled as capable of becoming skilled, to consider the technician in a dying classification trainable for a new one. And I say this with full understanding of the implication that our heart must show upon our corporate income statement.

My second point, and I will make it briefly, is that no discussion of employment as it affects the potential technical worker can leave out some degree of emphasis upon the fact that we are presently turning out of our elementary school process a larger and larger proportion of potential unemployables. As George Bernard Shaw said, "I often quote myself; it adds spice to my conversation." Last week in Yakima I had the welcome opportunity of talking to elementary school principals of the State of Washington, and said there: "Determination as to whether a boy or girl is going to finish high school is of course made before they get there. This is an old and a sore point with you and I know it has been discussed in this conference. You in the State of Washington have a very good record. Fewer than one out of every four of your students who begin the ninth grade drop out before high school graduation. In 1963, ninth grade enrollment is 53,100 children, which means that before or by 1967, 14,900 of those young men and women will have left high school without a diploma. Doing some projecting, in the ninth grade class of 1970 in the State of Washington, there will be 61,000 children, which means that 17,000 will fail to get their diplomas with the high school class of 1974.

"Now where you and I get together on this problem is where we note that dropouts are entering a labor market in increasing numbers and that this is a market where the number of jobs for the dropout people is steadily decreasing. To labor the point, you are producing more and more products for a market that is rapidly declining. The fact is that right now, on a national basis, without at least a high school education, no job is available in 6 out of 10 industries today."

"In the United States, 26 million boys and girls will leave school and seek jobs during the 1960's -- 40% more than during the 1950's. But of those 26 million, over 5 million will not have completed high school. I do not mean to thrust this problem aside with a casual business point of view, but to point out an obvious fact. Over half of the nation's unemployed is now under the age of 25 and every dropout helps swell that proportion.

"Last year Pacific Northwest Bell hired 1,600 employees. Of these, there were only five who had not graduated from high school and they had previous work experience which suited them for jobs with us. We demand more intellectual potential for the simple and obvious reason we can get it. We give employment tests of more sophistication than we did ten years ago. We do not hire a young man, even as a messenger, unless he is able to pass tests in basic intelligence, in science, mathematics and electricity, at a level commensurate with our demands. As long as we are able to secure potential beyond the immediate job, we will, of course, do so. What this means is that we no longer hire men for a specific job in our plant department. We hire them for what we feel is their potential growth within the business. Of course, the plant man will take different tests than the one hired for marketing, but the point is that we no longer look upon this man as a career switchman or a career salesman, but as a career telephone man."

We cannot tackle prospective employment of technically capable people without tackling the problem of unemployment prospectively getting worse for those who are not qualified simply because they lack sufficient education to have become adaptable. We are already at the place where adaptability and a high school diploma are practically synonymous.

To conclude, I have tried rather fumblingly, I'm afraid, to say two things:

The technology is changing so rapidly that we cannot afford the luxury of certainty, even in contemporary definition of the term "technician." This being so, we must work with the problem of technical employment with as much flexibility and adaptability as we possess. We must minimize our statistical attacks, for they are meaningless, and let our hearts labor with our heads, which surely will bring the elements of this conference closer together.

Secondly, I have tried to say we are producing out of our elementary schools a dangerously increasing number of unemployables who must be considered a part of what the advertising man would say, "this mix."

I wish I could be more helpful, even more positive. At least, I can assure you that one business and one businessman is concerned and working with the matter of matching manpower needs with the needs of men. I am hopeful you and we can find ways of working better and closer. Thank you.

Representing Industry

Peter C. Armentrout, Chief
Educational and Training Services
The Boeing Company

It would be presumptious of me to pretend that I can speak with authority concerning the use and importance of technicians in all of industry. I haven't done my homework that well. But I can tell you something about the importance of technicians in the aero-space industry and in The Boeing Company in particular.

In our industry we have been undergoing some rather severe changes in the nature of our work force. The technological expansion and change in the nature of our products have forced some rather drastic revisions in the types of people we employ. For example, in 1954 industrial workers made up 54% of our total payroll; today that percentage has dropped to 35. What is happening to us can be illustrated by the fact that in 1935 we designed the B-17 with 150,000 engineering manhours. The design of the B-52 from 1946 to 1952 required 3,000,000 manhours of design time and by the time the production model of that airplane flew, we had expended 10,000,000 engineering manhours on it. But producing the B-52 still required large numbers of industrial workers--riveters, sheet-metal mechanics, and so on. Now we are building missiles and space vehicles.

Technical problems continue to pile up, requiring larger numbers of engineers and scientists and fewer production workers.

We took our first long, hard look at the problem of supplementing our engineering work force with technicians in 1951. We had, of course, employed technicians prior to that time, but it was in 1951 that the pyramiding problem of increased technological requirements and the shortage of engineers began to assume such importance as to force us into a real effort to provide large numbers of employees to support our technical work force. One area in which we saw a need was that of the engineering draftsman. But we soon found that we could not employ trained draftsmen in the open market and decided to train our own. We were able to develop an intensive draftsman training program that in six weeks could turn a high school graduate into a usable draftsman. Careful screening and aptitude testing were required and the graduate was far from being expert at the conclusion of his training, but he could do a creditable job. We started this training program late in 1951. Many times we felt we were helping supply draftsmen for all the Pacific Northwest, but this was a hazard we had to accept. I can perhaps best tell you of the importance of technicians to us by telling you that since 1951 we have trained 5,215 such draftsmen. When you realize that on each of these we have expended a minimum of 240 hours of paid time and that 240 times 5,215 equals about a million and a quarter hours you get some measure of the lengths to which we have gone to supply one type of technician.

As to the size of our present technician payroll, it will be somewhat a matter of definition. Most of our technicians are in two categories--

1. Engineering technician by definition includes all employees performing semi-professional functions of an engineering or scientific nature at a level which requires knowledge acquired through a technical institute, junior college, or other formal post-high-school training less extensive than four-year college training, or through equivalent on-the-job training. The engineering technician assists the engineer or scientist and supplements his work. Typical job titles are Draftsman, Engineering Aide, and Laboratory Technician.

2. Semi-technical which includes all employees performing duties in support of production or production engineering functions and which require specialized training or experience. Typical job titles are Plant Planner, Production Illustrator, and Tool and Production Planner.

In these two categories combined, we have a group which makes up 12.4% of our total Seattle-area employment. In 1954 these two were only 4.1% of our total. In absolute numbers this group is now about six times its 1954 size. If we consider only the engineering technician group, there has been a similar growth. In 1954 we employed 775. We now have 4,082 in this category. By way of comparison, our group of engineers and scientists has increased from 13.3% of our total to 16.8%. This, of course, represents an increase in total numbers, but the increase has not been as great relatively as it has been in the technician groups. Expressed in another way, during the same period in which our engineering employment has increased about three times, our technician group has grown to six times its 1954 size.

Now, what about the future as far as technicians are concerned. It is here that I am about to express an opinion that runs somewhat counter to what has been or will be expressed by others here. At the moment we cannot see any great growth in the number of technicians our industry will employ. Here is one fact--if we consider again our group which we call engineering technicians (the draftsman, engineering aide, the laboratory technician categories), this group has grown from 2.2% of our total in 1954 to 5.5% of our total. But let's consider the rate of increase--

1954 -- 2.2%
1959 -- 5.3%
1960 -- 5.6%
1961 -- 5.5%
1962 -- 5.0%

Present -- 5.5%

The growth took place between 1954 and 1959 and since that time has remained a fairly constant percentage of our total with even some dips. During that growth period we were doing the bulk of that draftsman training I told you about earlier. Significantly, we haven't trained a draftsman now for at least the past year. Slightly over a year ago I told an audience like this that we had never had and probably never would have enough electronic technicians. Less than six months later due to a hiring campaign that was more successful than any one expected, we stopped hiring electronic technicians. You learn to be just a little more cautious after a flood of phone calls saying, "Why can't my brother (or my son or father-in-law) get a job? He's a technician and you said Boeing needed them."

Now, of course, I am not saying that we will no longer need technicians. But I am saying that at least as far as our industry is concerned, we think the boom is over. Naturally we are going to need technicians. To replace attrition will require us to continue to search out a fair number each year. But again, let me say that we expect the number we employ to remain at approximately its present level.

One area frequently under question is that of the electronic data processing technician. "Won't we need tremendous numbers of these people in the future?" we are asked. This area is currently under extremely careful scrutiny. The answer here also seems to be that we can foresee no great increase in the numbers we will require.

Certainly, I could be wrong--just as I was wrong last year--but we don't think so. We are taking a long hard look at our manpower problems. We certainly don't claim to know all the answers, but that is the way we now see the situation.

If I'm wrong again, I'll expect at least one-half of you to give me a phone call.

REPRESENTING HEALTH SERVICES

John R. Hogness, Associate Dean
School of Medicine, University of Washington

Although the various aspects of the provision of medical care are not commonly thought of as an industry, the over-all field is, in fact, one one of the largest industries in the state and in the nation. If one considers all purveyors of medical care including hospitals, physicians, dentists, insurance companies, supply houses, drug companies, etc., it becomes apparent that this is indeed a big concern. The total expenditures for health and medical care in the United States, for example, exceeded 29 billion dollars in 1961. Of this, private expenditures accounted for 76%. Not only is the industry large but it is growing extremely rapidly. Between the years 1929 and 1961, the aggregate expenditure for health care increased by about 700% in the United States, from a low figure of 3.6 billion in 1929 to over 29 billion in 1961.

The size of the industry is matched by its diversity. When one considers the number of different types of individuals involved in the production of health care, all the way from research scientists to medical supply house detail men, one can get some feeling of this tremendous diversity. Because of this diversity, there are, in various areas of the health industry, a great many technical personnel who have interests and training in common with similar personnel in other industries. However, there are a number of areas in the health field in which there are technical people who are more or less unique to the health industry. It is these people I intend to discuss today.

It may be of interest to list very briefly some of the types of technical personnel in the health field for whom training programs of one form or another already exist within the State of Washington. I should say at the outset, before beginning my list, that of course in this field as in others there is the usual argument as to which field represents a profession and which field represents a technical one. I do not propose to get into such a discussion at this time and therefore, with apologies to any representatives of the various fields involved who may be upset I will proceed:

1) There are at least four different types of training programs for nurses existent in the State of Washington--more about this later.

2) The University of Washington conducts a training program for physical therapists which is a four year degree program, and

3) also conducts a degree program for occupational therapists which is of similar duration.

4) There are a large number of training programs for laboratory technicians who provide technical assistance in the many varied fields in the health sciences. There are formal programs for training in general laboratory technology and there are training programs of a more or less formal nature to train a great number of specialists in this field. (For example, x-ray technicians, electroencephalography technicians, electrocardiography technicians, chemistry technicians, microbiological technicians, hematological technicians, etc.)

5) In the dental field, there is a training program for dental hygienists at the University of Washington School of Dentistry. This is a four year program and the graduate receives a bachelor's degree from the University. I understand that several two year programs for dental hygienists are developing in community colleges around the state.

6) A program for training dental assistants is also in effect at the dental school.

7) Another area in which technicians are trained is the field of inhalation therapy.

8) In addition, there are training programs for vocational counselors.

Although it must be recognized that many of the types of people listed above do not fit into the usual concept of a technician in a technological field, they are in fact the equivalent of such scientific personnel in their own fields and must, therefore, be considered on a technical level in describing this type of industry.

I should like now to discuss two of these general programs in more detail: The programs for laboratory technicians and those for various types of nurses, since these programs represent a large bulk of the technical man power in the health industry and since they also point out some of the problems that face the industry in the development of adequate, highly skilled technical people. Some of these problems, parenthetically, face all technical training programs to more or less degree.

Not too long ago, the term "laboratory technician" in the medical field almost automatically brought to mind one particular type of technician. She was a girl who had gone through a period of from two to four years of training and who was proficient in the performance of a number of fairly routine laboratory tests including certain simple chemistries, blood counts, urinalyses, microbiological techniques, etc. A person with the same type of training was usually suitably employed in a variety of different circumstances including the hopsital laboratory, a physician's office, and a research laboratory. The areas of training were fairly standardized and fairly consistent and constant throughout the country.

To a large degree the training programs in the field of medical laboratory technology still reflect this original, fairly recent, concept. Some such programs have grown up in relation to universities, (the University of Washington has a medical technology training program of four years duration which ends with a degree), other programs have developed with affiliations between colleges around the state and certain hospitals. Finally, some programs have been centered in hospitals alone with no college affiliation. There are at present some 12 programs, of one type or another, in the State of Washington. In the past, such programs have produced very capable general technicians who were trained to do a variety of relatively routine procedures without (with rare exceptions) a great deal of background as to the whys and wherefores of the techniques and procedures performed.

A recent analysis of the activities of technicians trained in this way has been very revealing and causes a great deal of concern. On the average, such technicians spend four years in their training, if one includes the college part of the training period. The average period of time a laboratory technician functions as a technician after graduation is two years. This means that the girl, and she is usually a girl, spends four years in a training program and works for only two years before giving up the field entirely. Not a very efficient use of time or money and hardly realistic from an over-all training point of view.

More important, recent changes in the body of scientific knowledge in the general field of biology have resulted in a virtual revolution not only of the basic scientific knowledge but also in the application of this knowledge, particularly in the field of medicine. The number of laboratory procedures performed on patients in the establishment of a diagnosis have gone up enormously. The physician is therefore far more dependent upon the laboratory than he was 10 or 15 years ago. Not only have the numbers of procedures increased enormously but the complexity of these procedures has increased even more dramatically. Along with the increase in the complexity of procedure, there has been a vast increase in the complexity of the instrumentation necessary to perform the procedures. This alone requires a great change in the training of the technician who is to perform them. Finally, with the increasing complexity in the health industry, many more areas are training technicians to perform certain functions that were fromerly performed by professional people.

This all adds up to the fact that the laboratory technician generalist alone no longer suffices for our present needs. It is imperative that we train two types of laboratory technicians: 1) The generalist who again would function as described above in certain special small localities or small institutions, and, 2) the need for a very great number of laboratory technician specialists is rapidly becoming apparent. We need specialists in x-ray technology, specialists in certain complex chemical techniques, specialists in microbiology, etc. Our current formal training programs have not kept up with this need and it is vital that those concerned with the training of such people recognize this fact so that we may adapt more rapidly and more adequately to the on-going revolution in biology.

Turning now to the field of nursing, a number of parallels with the area of medical technology become apparent. Both groups function at somewhat the same levels of responsibility. Of course, many other factors make it difficult to compare nurses with laboratory technicians directly since their functions are so different.

A serious shortage of nurses exists in this country and in this state at the present time. This shortage has become worse rather than better for a number of very complex reasons.

Throughout the country, the admissions to general hospitals have increased approximately twice as rapidly as has the population. The need for trained technical personnel in general hospitals has increased at approximately four times the rate as has the population. Despite this fact, during the past ten years, the number of new nurses entering the field of nursing has increased by only four per cent. This has resulted in a very serious imbalance and an acute shortage. In effect, this shortage has brought about the development of various types of programs which have attempted to provide substitutes for the registered nurse. There has been a shift away from the staffing of hospitals with registered nurses to staffing with other types of technical personnel. Last year only 30% of the general staff in nursing departments in hospitals around the country were professional nurses, and one-third of this 30% were working only part time. An average of 20% to 25% of positions for nurses are vacant in hospitals throughout the country.

If we try to project this situation into the future, it would seem apparent that the forces which have been at work producing the present imbalance will continue and the problem will become even greater. The population will probably continue to grow at an even faster rate. The increase will occur particularly in the age groups requiring more nursing care. There will be more insurance coverage so that more people will be able to afford hospital care and hence will be taken care of in hospitals. The advances in medical science mean that more can be done for the sick patient than was formerly the case, but in caring for the sick patient more and more technical personnel will be needed. It would be possible to continue almost ad infinitum listing the changes in the future which will require more and more specialized personnel to care for patients. To reach a satisfactory solution to the many problems confronting us in the nursing field it will be necessary to re-evaluate all of the training programs in the field and to study what can be done in the establishment of new technical programs.

At the present time in the State of Washington four different types of schools for nurses exist:

1) There are the hospital schools which require a training period of three years with the graduate receiving a diploma in nursing. She is an R.N. Graduates of the hospital schools account for 82% of graduates in the state. There are ten such schools in the State of Washington at the present time.

2) The college nursing schools conduct a four year program and the graduate of this program receives a bachelor's degree and is also an R.N. There are four such institutions in Washington and their graduates account for 14% of the nursing graduates in the state.

3) A new and rapidly growing training area is that of the community college school. There are five such schools in existence at the present time in the State of Washington. They conduct a two year program and at the present account for only 4% of R.N. graduates in nursing. However, these schools are relatively new and we can look forward to a very rapid increase in this area.

4) Finally, the practical nurse-vocational school should be included. Graduates of schools such as the Edison Technical Institute here in Seattle study practical nursing for one year and are called licensed practical nurses (LPN).

If we are to solve the acute shortage of technical assistants in the nursing field, there must be a rather marked increase in the numbers of schools on all of the above levels and in the numbers of graduates from these schools. It would not seem unreasonable to anticipate an increase of 60% in hospital schools, a doubling in the number of graduates of degree schools, and a quadrupling of the number of graduates of the community college schools. It is only in this way that we can meet the acute problems facing us in the health industry.

To conclude:

As the cost of medical care and health services in general increase, as it will continue to do in the future, there will be an increasing need for technicians of various types in all of the diverse fields of biology.

1) In the field of nursing, not only will we need four year graduates to act primarily as supervisors but we will need a vast increase of graduates of the three and two year schools and many, many more licensed practical nurses.

2) In the field of dentistry, many technical procedures which are now performed by dentists, particularly the manufacture of dentures, etc., might well be considered as ripe fields for the development of technical programs of training.

3) In the field of medicine, it would seem appropriate to consider the development of training programs for technicians in the field of suturing techniques, the field of cast applications and removals, and many other similar programs.

In fact, in the entire field, as has been true in other industries in the past, all procedures should be analyzed to determine whether or not technical help can be substituted for professional activities, thereby making the provision of health services more efficient and less expensive.

REPRESENTING GOVERNMENT

Lee Parker, Supervisor
Examination Section
Washington Department of Personnel

Although I have been asked to present the picture of technician manpower needs within government in the Northwest, I will tend to give primary emphasis to state government needs, for the simple reason that this is the area of my greatest knowledge. However, I will attempt to present some of the picture as seen by municipal and federal government levels also.

Aside from the people who work for the colleges and universities, the State of Washington employs approximately 4600 semiprofessional technical personnel. The federal government, the municipalities, and the county governments collectively within the State of Washington employ a significantly greater number. If you were to multiply the number of technicians employed by the city of Seattle by the number of municipalities in the state on a prorated basis, add the number of technicians employed by county governments, state government and the federal government, and then multiply this grand total by the number of states representing the Pacific Northwest, you would come up with quite a sizable figure.

In state government the assignments range from preventive medicine, through psychiatric treatment, communications, and natural resources preservation, to civil engineering. It has been convenient to classify these jobs into about 75 different groupings based on similarities and differences in specialty and level of responsibility. Some require bachelor's degrees or higher, and all require some formal specialized training, whether in colleges or trade schools or at the place of employment.

There are Sanitarians who see to the maintenance of adequate public health standards in our water and sewage systems; in the production, handling, storage and sale of dairy and other food products; and in public gathering places. There are Environmental Chemists and Industrial Hygenists whose work involves the air sanitation and radiation control programs of the State Health Department, and the measurement and control of industrial air contaminants and environmental health hazards in such work sites as mechanical and chemical manufacturing plants, mines, and automobile garages. There are Safety Inspectors who inspect for, and promote safe working conditions in industrial plants, commercial establishments, construction projects, and logging operations. And there are Laboratory Technicians who work in clinical and pathology laboratories dealing with such matters as body fluids, tissues, pathological organisms, X-rays, electrocardiographs, and the like. Entering-level Microbiologists should probably be mentioned here too; although, as more formal training and experience are obtained these people certainly move into the realm of the fully professional; but the same would also be true of much other work which we tend to refer to as "technical" as distinguished from "professional."

The state employs Dental Assistants, Licensed Practical Nurses and Hydrotherapists in the various institutions of which there are 20. Large numbers of practical nurses work in the three mental hospitals, the schools for the mentally retarded and in the infirmaries and hospitals within the other institutions.

I will also mention Physical Therapists and Occupational Therapists here, especially at the entering level, although they may be, and probably are "professional" in much the same sense as registered nurses. They are required to hold bachelor degrees from schools of physical therapy and occupational therapy respectively which are accredited by the American Medical Association. Their schooling must be supplemented by supervised clinical training in their respective specialties, and they must be eligible for registration by their respective professional certifying bodies.

The vast amount of data with which the state deals makes fertile ground for the development and use of electronic data processing systems. Hence, the need for Electrical Accounting Machine Operators who must be trained in the operation and wiring of electrical accounting machines; of EDP Computer Operators who know how to prepare input data and operate consoles and the various peripheral equipment in an integrated, stored-program, EDP system; and of Systems Programmers who can analyze, design and prepare programs and operational routines for processing on EDP equipment. Again, the more training and experience an individual has and the more he is capable of accepting responsibility and exercising independent and creative judgment the more he moves from the realm of "technician" to the realm of "professional."

Then there are Statisticians and Research Analysts whose training or experience is sufficiently limited to warrant calling them technicians and who work primarily in social or economic research and analysis. And there are also Psychological Research Aides, Occupational Analysts, Personnel Analysts, and Aptitude Test Technicians.

In the communications arena the state employs as Editorial Assistants, Photographers, Graphics Aides and Artist Illustrators, people who can gather, prepare and disseminate informational material by means of various media such as: news stories, reports, instruction manuals, photographs, charts and graphs, signs, maps, visual training aids, etc.

In the agricultural and natural resources area there are such jobs as Seed Analysts and Inspectors who inspect seed fields and processing establishments and analyze seed to assure compliance with state and federal law relating to such matters as purity and viability; Grain Inspectors; Apiary Inspectors; Fish Hatchery Technicians, Assistants, and Supervisors; Log Scalers; Forest Check Cruisers; and Forestry Aides who perform engineering-aide type duties in a forestry setting. Marine Seismic Observers are also employed to protect the interests of sea-food production in Washington State coastal waters when explosives are used to induce seismic reactions during the conduct of geophysical surveys by marine expeditions.

In the Electronics and Civil Engineering fields, we have Radio and Television Repairmen, Radio Technicians who must be able to overhaul, repair, and maintain two-way mobile radio communications equipment, as well as fixed radio transmitters, receivers, antennas, microwave and associated equipment, and all related actuating and control equipment; Radiation Technicians who calibrate and repair radiation detection and measurement instruments; Geologic Aides who assist geologists in geologic mapping by using surveying instruments, collecting rock samples and preparing maps and charts; Engineering Aides and Technicians who work in the field as members of survey crews or in the office doing drafting, tracing, computing, plotting graphs and charts and operating and maintaining blueprint machines; and other Engineering Technicians who engage in such specialties as traffic analysis, planning, photogrammetry, materials and soils investigations, and cartography.

Much the same picture exists in the federal, municipal and county operations. Generally speaking, technicians and semiprofessional personnel are employed for the specific purpose of assisting professional personnel by relieving them of many of the technical details of their work; thus, allowing them to devote more of their time and energy to the professional aspects of the employer's business for which only they are adequately equipped. The assumption has been that an increased use of technicians would relieve the problems growing out of the shortages of professionally equipped personnel while the demands for professional services increase at high rates. There has been a further assumption that a generally realistic ratio between these two groupings would be two subprofessional assistants or technicians to each professional position.

None of the governmental jurisdictions, however, has been able to maintain this kind of ratio. We have been caught up in the trap of hiring more professionally trained people simply because they have become more available than have the technically trained. This is quite an irony. We pursue substitutes because of a shortage of the real thing; find the substitute in shorter supply than the real thing; employ the real thing for the substitute and thereby reinforce the shortage of the real thing.

The other day I was looking at the 1960 census figures for the State of Washington and I came across some fascinating numbers. Although the census reports did not differentiate between types of employer, it did differentiate between the scope of the experienced civilian labor force of semiprofessional technicians within the State of Washington and the number of people actually employed within these categories. In 1960 there were 910 experienced male medical and dental technicians in the labor force in Washington of whom 902 were employed and 1467 females of whom 1455 were employed. There were 2242 male and 36 female electrical and electronics technicians in the labor force of whom 2205 and 36 respectively were employed. There were 2923 male and 610 female technicians in the labor force covering other engineering and physical science categories of whom 2864 males and 583 females were employed. And there were 726 male and 293 female technicians in the miscellaneous category of whom 709 and 282 respectively were employed. In other words, within the State of Washington in 1960 there were about 10,000 experienced semiprofessional technical personnel in the labor force of whom 9,000 were employed. Many of the unemployed were unemployed by choice, and others were in transition between jobs.

In light of the demand within government alone for technically trained personnel these census figures give rather vivid support of the fact that the supply falls far short of the demand. What are we in government doing about it? We are probably doing the same thing most employers in the private economy are doing. We are encouraging the development of trade and technical schools in our communities; encouraging the expansion of training programs within existing facilities; and developing training programs within our own jurisdictions. In desperation we are exploring ways of further engineering our jobs into sub-subprofessional levels and exploring the feasibility of lowering selection standards.

I mentioned a while ago that the State of Washington hires large numbers of Practical Nurses. The state has had a critical shortage of qualified nursing personnel in its hospital system, and an educational program has been inaugurated in an attempt to relieve the problems associated with this shortage. With the shortage relieved, psychiatric patients, of whom there are large numbers in the state, will receive the quality of nursing care they need. The training program is built primarily around increasing the number of available skilled and licensed practical nurses and involves collaboration between the Department of Institutions, the State Division of Vocational Education, and such training facilities as Clover Park Trade and Technical School in Tacoma. Students enrolled in the one-year course receive clinical training in local general hospitals as well as at the state hospitals and become eligible for licensing upon successful completion of the program. Similar training programs have been or are being instituted for other technical specialties also.

I would say that as our population continues to grow, as our fund of technical knowledge increases, and the demand for higher orders of skills increases, the need for technicians of all kinds and the training facilities for their production will increase at rates which are a little difficult to envision; but envision and prepare we must.

"EDUCATIONAL PROGRAMS FOR SUPPLYING TECHNICIANS"

Athol R. Baily, Associate Professor of
Industrial Education, University of Washington

If one word were used to describe our present society, it surely would be change - yes, change, with a rapidly increasing tempo. Change in itself is not new, but the rate of change is new.

To illustrate this I am borrowing from Norman Harris, who borrowed a time compression device credited to Dr. Thomas D. Bailey, Superintendent of Public Instruction of the State of Florida.

"Suppose that mankind has had approximately 50,000 years of history. To make this span of time more comprehensible apply a time compression device and squeeze it into 50 years. By this abbreviated scale man emerged from the cave ten years ago. In other words the first forty thousand years of Man's existence on this planet represented very little progress. The rate of change wasn't very great. Five years ago we invented pictorial writing, and these artistic efforts of our forebears are evident on cliffs and cave walls in many parts of the world. Two years ago Christianity was born, and fifteen months ago the first Bible was printed at Gutenberg. Ten days ago electricity was put to practical use by Edison. Last week the Wright brothers flew at Kitty Hawk. Radio was invented yesterday, and the "Roaring Twenties" and bootleg booze occurred between midnight and two a.m. this morning. Television was here in time for this morning's newscast, and Gagarin, Shepard, Grissom and Glenn landed back on earth as I am saying the last words of this sentence."

Many of us in this room are a bridge between two ways of life--one gone forever and the other rushing ahead into the unknown. No other generation in the history of the world has seen so much change so fast. Let's reminisce a little while.

Many of us can remember handmade soap, work horses, dawn to dark effort in the fields, band concerts in the park, Fourth of July celebrations at which the children romped while speeches were made, hand cranked ice cream freezers, striped candy bags, meadows and woods inside the city limits, an abundance of fish and game, dusty country roads on which an auto trip was an adventure, farms that supported families, trolley and cable cars as the only way to get around a city; when silent movies with the gum chewing pianist or organist gave way to talking moving pictures - Al Jolson and Sonny Boy. We made crystal radio sets, with cat whiskers, then superhetrodyne sets, and spent the evening with headphones, listening for different and distant stations, KOA Denver, KSL Salt Lake, KVI Los Angeles; Amos and Andy, Kate Smith. We marveled at the shiny new plastics (bakelite) and air conditioning. We greeted with some misgivings super highways, neon lights, television and the jet airplane. We can remember when a compact meant something that a girl carried powder in. When the purpose of school was reading, writing and arithmetic and the Golden Rule; when babies were on schedules which could not be altered. They could not be picked up except at certain times. When you could buy any color of

Ford you wanted, as long as it was black; when the airflow Chrysler made its debut; when the electric starters reduced the doctors' income because of reduction in broken arms; when holding out your hand in a certain manner meant that you were going to turn; when you bound and shocked wheat and threshed it with a steam rig. When a cloverleaf meant good luck; when to take a trip meant to go outside the state; when teachers were thought to be walking encyclopedias. When you stepped up into a car; when cars had running boards. When the old rocking chair got you by the time you were thirty or forty; these are just a few.

This generation is the link between the near--yet nearly forgotten--past and the unfolding future. We provide the ideas and memories our children will take into lives we shall not share with them. We are their bridge, for better or for worse.

We as a nation have passed through an earlier industrial revolution in which our whole social structure was altered. The kind and number of workers needed were radically changed. The production worker was introduced into our social structure with all of its implications and problems. The type of training program (namely apprenticeship) that had for decades, yes, centuries, done a successful training program for those who worked with their hands, slipped into disrepute. It was not designed to train the type of worker needed by the new industrial society. The problem of training this new production worker became apparent and real and became the concern of many groups of people. The challenge was met and we have developed into the greatest industrial society yet to be known.

Today we stand on the threshold of possibly an even greater industrial revolution, namely automation and space age problems. Even today, like in past years groups of people are gathering to study, analyze, define and attempt to find solutions to the immediate and urgent problem, one of which is the technician and the training program or programs necessary to provide this new type of worker.

There is no doubt in any of our minds as to the necessity for, or place of, this type of person in our industrial and social structure. This was ably presented yesterday by Dr. Giles--Mr. Brunner on the national level, Mr. Straley, Mr. Armentrout, Mr. Hogness and Mr. Parker on the local level.

SOME PROBLEMS TO BE CONSIDERED

We are all aware of the need for this individual, so let's take a closer, more detailed look at the problem and several major facets that appear early in our deliberation. They are:

1) What is a technician?
2) The sources of technicians
3) What kind of training is necessary?
4) Who shall provide the training?
5) Where are we going to get the teachers for technicians?
6) What are the qualifications necessary for teachers of technicians?

7) What training will be necessary for the teachers and who will provide it?

8) The research that is needed in this area

The problem of placement, if an adequate program is carried out, should be no problem; rather the problem will be how to hold the trainee until the completion of the training program.

WHAT IS A TECHNICIAN

To consider the first topic--the definition of a technician. Since the word is used rather freely and loosely, the definition of a technician in one occupational group may not define a technician in other occupational groups. For different occupational groups the term technician can have different meanings. Some people think of the work of the technician as being vocational-technical in nature and is to be realized by the upgrading of the skilled craftsman. Other groups think of the work of the technician as more of a semiprofessional occupation, serving as support personnel for professional people, such as engineers, scientists, doctors, and so on. Closer scrutiny of both definitions will disclose that the two groups are considering the same occupational group. It appears and in reality it may well be that the technician is a part of a continuum of workers, some place above the skilled craftsman's level and somewhere below the level of the theoretical engineer. The technician is possibly a liaison person between the two groups, who must be familiar with the technical problems of production as well as the scientific principles involved. The technician is a person who can communicate with each group.

THE SOURCES OF TECHNICIANS

One source of technicians will be from the ranks of the craftsmen already working on the job. Another source will be from those in higher education--the junior college, the four-year college and the university, while a third source may be from the high school graduates.

WHAT KIND OF TRAINING IS NECESSARY

Each of the groups mentioned, due to different background, will require a somewhat different program of training. They may be similar in some respects, they may even be identical in some respects.

In planning any training program it is necessary to consider the factors of the previous experience and training of those to be trained. It is also necessary to analyze the kind of work to be done on the job, making a list of the things a person must be able to do, another list of the things a person must know and still another list of the things a person must be. Such an analysis must be a joint effort of labor, management and the educator. With this information it will be known just what kind of training and background the perspective technician will need to take with him to the work.

With this information available and since in any case the future technician will be a product of the secondary schools, the counselors should be more effective in this phase of counseling. Counselors know how to counsel the college bound student effectively because the college entrance requirements are written in college catalogues. It is also highly probable that some of the basic preparation might possibly be designed and given in the junior and senior years of high school.

In further consideration of the problem of technician training, we are confronted with several different factors.

1) Is there some basic training that is needed by all technicians and could be taught in a common class?

2) Is there some type of training that is peculiar to each group and must be provided in segregated classes?

3) Must we tailormake each program for each group?

4) Should the training program be all related material, heavily loaded with demonstrations, scientific principles, necessary mathematics, or should it also include some manipulative work and practical problems?

5) Would some kind of a work-school program be desirable and effective?

By making the kind of analysis previously mentioned some of these questions can be answered. Once the above questions are answered the groups, namely, employers, vocational educators, those in higher education, should get together to design programs that will be effective in the training of technicians.

WHO SHALL PROVIDE THE TRAINING

There seems to be considerable concern and interest in this facet of technician training by many groups. At present there are two groups that are intensely interested in the training of technicians, but at present are not sure just how to get the job done. These two groups are the vocational educators and those in higher education.

The vocational educator says that the training is vocational because vocational education historically has meant training people for work and since it is technical in nature they should do it. It could be done in adult evening classes, trade extension classes or vocational-technical institutes.

Those in higher education consider the work of the technician as more of a semiprofessional occupation and more as support personnel for professional people such as engineers and scientists and they feel that they should do the training within higher education through the junior college, private colleges, four year colleges and the universities. Representatives of each of these groups will discuss their interest and possibilities of the program of technician training.

WHERE ARE WE GOING TO GET THE TEACHERS

Even though the groups have worked together to decide what the content of a training program for technicians might be, and possibly have developed courses of study, the course of study even though it is the best available has no value in itself unless competent teachers are available to organize and present the materials and to evaluate results. This facet of technician training presents the following problems:

1) Where are we going to get the teachers?
2) What are the qualifications necessary for the teachers?
3) What training will be necessary for the teachers?
4) Who will provide the teacher training programs?

One source of teachers may be those already working as technicians. Another source may be those who are in higher educational programs who felt they wanted to enter the professional aspect of the occupation but changed their minds after being in the program for awhile. I do not mean those who are flunking out, but those who entered the professional training program with sincerity, but found out that they did not like to deal in abstraction but would prefer to deal with the more practical aspects of the occupation, or those who were not financially able to carry out the original programs.

QUALIFICATIONS OF TEACHERS

The qualifications for the teachers of technicians regardless of the source remains the same.

1) They must know the subject matter or have something to teach.

2) They must know the principles and techniques of teaching and how to use them effectively.

3) They must be interested in teaching and have a desire to teach.

If any of these three are lacking the program will suffer.

Just having worked in the area is not enough, nor having just background of theory, scientific principles and in some cases mathematics is not enough. They must have both--the academic and the practical must join hands in this effort. Each must understand and appreciate what the other has to offer and frankly cut out the bickering. Both are necessary and must work together to get the job done.

WHAT TRAINING WILL BE NECESSARY FOR THE TEACHERS OF TECHNICIANS

Since the background of the two previous sources mentioned are quite different it will be necessary to provide a program that will make them both effective. For those who have had only work experience, courses in necessary mathematics, scientific principles, methods of teaching and possibly a cadet teaching program will be necessary. For those who have had an adequate scientific and mathematics background some type of work experience or internship must be made available as well as methods of teaching and possibly cadet teaching. As a matter of expediency we may have to tailor-make a program for the teachers of technicians.

RESEARCH NEEDED

To develop an effective program it appears that considerable research may be needed in the areas of job description, analysis, content and teaching techniques. The need for technicians is urgent and we may not have time to carry out all the research that would be desirable before starting the program but at least we are aware of some of the problems confronting us.

These remarks have been rather general in nature but I hope have been presented in a logical pattern of procedure for developing educational programs for supplying technicians.

REPRESENTING ADULT EDUCATION

Dean H. Goard, Assistant Director for Adult Education
Vancouver, B.C. School District

Mr. Chairman:

I would like to take this opportunity to thank, through you, those responsible for this Conference who were kind enough to extend to me an invitation to come here and take part in these discussions. I hope that it will prove interesting to the group to listen to some observations on this subject from a visitor from a different country where the training of technicians is also a matter of concern and study.

In his address, Dr. Bailey emphasized the rapidity of change in our technological society today. In addition, he mentioned the increased use of technically trained workers, "technicians" who fill many of the non-professional technical jobs in industry as one of the current changes in our labor force pattern. Another change, which might have been mentioned, is the increasing reliance of industry on public educational facilities to provide some of the training for such new groups of workers as technicians. In all of these considerations however, the speaker's main theme was not so much change itself but the increasing rate of change in technologically-based industry today.

I am sure that all of us appreciate the nature of the dynamic equilibrium that exists between schools and industry in our modern urban society. Young people are leaving our schools at least partially prepared for industry and older workers are returning from industry to our schools for part-time refresher studies to improve their performance and mobility in work. In the "technician" group the school has a large part to play in supplying technical training which is essential to both the new entrant to this field of work and equally essential in refresher courses for the employed worker. In technician training programs, therefore, it is particularly important that this equilibrium between school and industry be kept in good balance with both industry and school playing their full and effective part.

Now to make my first comment on Dr. Bailey's address. If it is true that the rate of change in industry and in its labor force patterns is increasing rapidly; and if it is equally true that some sort of dynamic equilibrium exists between school and industry in training workers for and in the labor, then it follows that the schools supporting these training programs should be developing and adjusting at an equal rate to that prevailing in industry.

At this point, however, permit me to wonder whether or not we in educcation are rising to meet this challenge? In particular, are we developing new programs to meet the need for technician training or are we still struggling to define technician training in terms of traditional school practices and still debating in what kind of educational institution these "technician" programs should be housed?

Surely the technician group is just one section of a whole spectrum of vocational and technical occupations and it is impossible to satisfactorily segregate this group from the rest. Indeed it probably serves little purpose to do so. I would ask you to reflect that, if no one had coined the word "technician," our task at this conference would have been immeasurably easier. Unfortunately, once a term or label is invented there are those of us in education who consider it a fundamental duty to define and isolate it. I would venture an opinion, that if technician training had been considered as just another of the training programs within the scope of present technical and vocational education, we would not be so concerned about setting up special institutions to meet this need. Nor would we be debating what kind of educational institutions should house these programs.

To return to Dr. Bailey's estimate of the rate of change in technological industry and its implications for industrial education as a whole, I believe that the essence of our problem is to develop educational services that can react and adjust rapidly to meet the changing demands of industry. Our pattern of services must be operated in the most flexible manner. In order that education can provide flexible service to industry, I submit that we must organize our thinking and our techniques on the basis of programs to meet specific needs rather than on the basis of types of institutions. We must learn to think in terms of programs rather than in terms of institutions if our reaction time is going to match the rate of change in industry. Or are we too satisfied with our present educational institutions, traditions and practices that we will allow these customs to prevent us from providing the flexible programs that a changing industry will require?

Since my experience in Canada has tended to make me a "program" man rather than an "institution" man in my approach to these matters, I tend to avoid debates about housing of "technician" programs. I take the view that if the program is good and serves the purpose for which it was designed and its integrity is maintained by an industrially-oriented administration, then it does not matter very much under what roof it is sheltered or with what other programs it is associated. Therefore it does not matter whether a good program is housed in a Technical-Vocational Institute, Technical Institute or Community College. It is important that the program is good; it is important that it prepares people properly to take their place in industry. It is important that these programs be initiated quickly and terminated quickly if they no longer serve a useful purpose.

If we must talk about institutions, however, I think I should make this comment. In general, the trend in Canada is to the Technical-Vocational Institution in most provinces. If an institution is built to serve a geographic region, the technical-vocational institution provides a more flexible service than the technical institute per se. You see it avoids the rather futile debate that centers around the definition of "technician." It avoids the unnecessary problem of separating the "technician" occupational group from the whole spectrum of industrial occupations. As I have observed it, the Technical-Vocational Institute has no "built-in" reservations about meeting the demands for technical training at any level in the spectrum. The separate Technical Institute might have reservations about supplying technical training to a skilled trades group and would therefore be a less flexible instrument. Since both types of institutions share a similar industrially-oriented educational philosophy, I can see no difference on that score. The Technical-Vocational Institute appears to be a more viable and flexible type of educational institution than the Technical Institute.

I find it difficult to comment on the role of Community Colleges in Technician Training since these institutions are relatively unknown in Canada and I have had no experience with them. Basically, however, I tend to think in terms of programs rather than institutions so I see no reason why good technician programs could be housed in a Community College provided their integrity was maintained and the specific goal of the program was kept clearly in mind by a sympathetic and industrially oriented administration.

There is a fair chance that we will shortly establish such a college in Vancouver and we shall find out for ourselves how well such an institution can play its role in this field of training.

I believe that these Community Colleges are ideally suited to middle-sized and small communities as the only economical device that can provide these services in communities of this size. To the end that they bring technician training programs to a broader range of communities than is possible with more specialized institutions, they do contribute to the flexibility of the total services of a state or province. The problem of their suitability in a larger urban center, however, is very complex indeed and such an institution is only justified if it can economically provide programs that are not supplied by other institutions already established in the larger community. So, you see, I return to thinking in terms of programs rather than in terms of institutions as I must.

At this point, I might ask you to consider whether or not it is a "good thing" to hold a Technician Manpower Conference such as this. Now this proposal is offered in some measure, with facetious intent. However, I attended a large and successful conference on apprenticeship in Vancouver a short while ago. One of the apparent outcomes of that Conference was a general feeling that all industrial training problems could be solved by extension and expansion of apprenticeship philosophy and techniques.

There is a grave danger, I think, in studying certain types of training programs for industry in isolation from all other types of industrial education programs. I sincerely trust that none of you leave this conference with the view that training of technicians is something special and apart; and that no services of this nature can be provided to industry in your community unless you have a special kind of institution available to house these programs. I think it is important that we keep the whole range of school facilities and services in our mind when we talk of technicians' training. In the same way, we should keep the whole range of industrial occupations in mind when we consider the technician group in industry. To do any less is to acquire a distorted view of the training of technicians and a distorted view of their particular place in industry.

In this connection, let me compliment Dr. Bailey for his observation that the secondary schools have a role to play in this matter. For surely, adequate industrial and scientific studies for secondary school students provide an essential base for further preparatory technician training. And surely, the secondary school provides the counseling which direct young people into further technician training which in turn leads into employment in business and industry. The secondary school system is, in fact, the source of potential technicians.

Educators, as a whole, are inclined to think that all technical training takes place in school. They are inclined to overlook the formal and informal training that takes place on the job and to underrate its importance. Technicians are trained by industry as well as by school and, in fact, industry will generally have more experience in this matter than the school. This is part of the larger picture of technician training that must be kept in mind during these discussions.

When we consider technician manpower training at this Conference, therefore, let us consider it when properly located within the whole framework of total industrial educational services and the full spectrum of industrial occupations. And let us keep in mind that this training must be provided on the most flexible basis through programs which can adjust to industry's changing needs.

It may be of some interest to the group to mention that in British Columbia we have been going through an extensive and uncomfortable period of change during the past few years in respect of our total educational services, including training programs for technicians. In rapid succession we have experienced a Royal Commission investigation of our public educational system, a massive Federal Financial Aid program for technical and vocational education and a report and review of university and higher education. In short, all of our educational services from kindergarten to graduate study at the university have been overhauled and many changes have come in education in B.C. It is interesting to note that many of the changes have been imposed on our educational authorities by the community at large which, in the long run, is the final arbiter in these matters.

A Royal Commission on Education is a peculiar custom that is native to my country and I should observe that it provides an uncomfortable but salutory period of change in educational outlook and practices. One of the recommendations of that Commission provided for the establishment of a Technical Institute to provide training for technicians and that center will open its doors on September, 1964. In addition Adult Regional Vocational Schools throughout the Province were recommended and have been established.

A Federal Technical-Vocational Assistance Act of 1960 provided the funds for much of this expansion of vocational and technical education and to date across Canada one half a billion dollars in new technical training facilities have been provided. It is expected that an additional equal amount will be expended by 1967. Translated into terms of your country this would equal a twelve billion dollar program with six billion dollars of construction already completed.

I think it is fair to state that if your technician training programs and problems were part of a venture in which six billion dollars had already been expended that you would have come to some conclusions by this time in respect of these matters. We have been forced, by the events I have described, to make our decisions in respect to the present and future needs for "techncian training" and the types of programs which, we hope, will meet the goals we have established.

It is on the basis of my experience in our changing situation in technical and vocational education, and in particular, in technician training programs that I have spoken to you today. I trust that our changing educational services will, in some measure, meet the challenges of Dr. Bailey's time scale of our rapidly changing industrial society.

REPRESENTING COMMUNITY COLLEGES

Dwight C. Baird, President,
Clark College

The following is a summerization of Dr. Baird's remarks:

1. If the problem of providing sufficient numbers of trained semi-professional personnel is to be solved, the community college can and will play a significant role in the process. The fact is that the community colleges are probably the only educational institutions in the nation that have sufficient enrollment capacity to make a significant contribution toward meeting the national technical manpower needs.
2. The community colleges are established, operating institutions; they are capable of further expansion as the need arises; they are generally more responsive to local and regional needs; they are capable of making an immediate contribution to meeting manpower needs; they are operating on the basis of many years of successful experience in providing educational opportunities at the semi-professional level. Furthermore, a number of states have made and are now making provision for important expansion of the community college systems within their borders.
3. Private, as well as public community colleges have been and are now providing significant numbers of trained graduates for business and industry in their local areas. These individuals constitute a continuous and increasing supply of trained personnel in such fields as secretarial-business, the health sciences, service occupations, as well as the engineering-industrial vocations.
4. An important aspect of the community college semi-professional curriculum is the inclusion of college-level courses in the humanities and

social sciences. If the predictions about the need to retrain industrial personnel several times during their occupational life prove to be accurate, the general education background of the community college graduate should be a factor of increasing importance to the employer.

5. One outstanding factor of the community college program is the comprehensive nature of its curricular offerings. Typically these programs include vocationally oriented short courses for upgrading the employed, terminal vocational and technical training programs, as well as the pre-professional, lower-division collegiate preparation that can lead directly into employment or be used as an entree to advanced collegiate and professional education.

6. Another important aspect of the community college semi-professional educational opportunity is the fact that it offers collegiate-level preparation. During a time of high educational expectation on the part of many parents and in light of the values concerning a collegiate experience held by large numbers of today's youth, the community college seems to be admirably well suited to the task of meeting the personal needs of the individuals involved as well as the personnel needs of the nation. In addition, the costs of post-secondary school training to society in general and to the individual student in particular are relatively diminished through community college programs where the per-student costs are generally reduced. This makes higher education available to a greater number, provides it in the immediate geographic area, and ultimately insures a continuing supply of personnel for local businesses and industries.

7. The emphasis on the guidance and counseling functions in the community college is another factor that contributes to the effectiveness of these institutions in helping to meet the manpower need. A close relationship with the local secondary schools provides for an easier transition for some students as they move from the high school to the collegiate setting. This may well be a factor in motivating certain individuals to pursue any sort of post-high school education. These individuals, who may otherwise have been lost from the ranks of the trained worker, may in fact constitute an important portion of the future technical workforce.

8. It is reported that there is a steady increase in the ratio of technical personnel to professional-level people in business and industry. Since one of the major roles of higher education is to assist the individual in keeping pace with the changing character of modern society, it is important that the institutions of higher education recognize their obligation in the area of technical education. The major burden for providing this type of preparation traditionally has fallen on the community college. This will be increasingly more the case particularly in light of the fact that the spectrum of occupational opportunities no longer contains appreciable gaps so characteristic of past years. The preparation of personnel who can best satisfy the contemporary manpower needs can best be accomplished by the type of institution that successfully combines vocational and general education.

REPRESENTING STATE COLLEGES

P. H. Atteberry, Professor of Industrial Arts,
Western Washington State College

The two phrases that arrested my attention and compelled me to a commitment to this assignment were and I quote from the Chairman's letter, "The express purpose of the Technician Manpower Conference--is to bring together leaders from all related agencies and organizations to initiate action through intensive discussion of the technician manpower problem." To me this means long term research that will more nearly insure action in the right direction.

To take action on half truths or confuse statements of belief, with appropriate action would be to join the ranks that have not been able to tell the difference between doing work and talking about it. Frequently, in conferences of this sort, we tend to identify problems, state their magnitude, appoint a committee to write a summary report and then go home basking in a warm glow of accomplishment as if the problem had been solved.

We are caught up in a complex of interrelated conditions that affect the optimum use of our potential labor force, and our greatest natural resource, and the opportunity of each individual to be employed at a job commensurate with his ability. A time limitation in this paper will permit little more than the mention of some of the subtle changes taking place in the nature of workers, occupations, the organization of industry, related agencies, and in society. All of these agencies have a stake in the occupation-seeking preparation process.

Conditions of under and unemployment tend to be long term, what we might label chronic maladies as viewed from a historical Perspective. As an aside, all too frequently we have treated symptoms, and acted only in crises situations in all education and in technical education in particular. Healing over a sore that will break out again in the same spot or near by, all because we have not been convinced that the task was worth the time, effort and financial resources to pursue a plan that would remove the cause.

The fact that we have an acute problem of unemployment, in a time of business as usual, is a charge of failure on the part of some one or some group to meet this problem at the door step. Technical education or vocational education for the technician has never been supported or even considered by any influential segment of our educational machinery except in times of crisis. The equipment for our technical schools and vocational schools has historically been hand me downs from some sort of a government or national defense program--one of our world wars, the CCC, the NYA, the National Defense Training Program, now Cold War. This is not a criticism of the doner but Crasley says, that in general the local community has not been interested in this program enough to buy the kid a new pair of pants. So they depended on hand me downs.

Some areas that would appear to call for re-evaluation are: the historical separation deriving from source of financial support, below college grade; a regulation to guarantee that this money would not be used to educate workers for the professions or general education. Technical education is now in this strip of 'no man's land' being buffeted about with good intent we trust by all. Where does it belong? Is it below college grade in depth of content and level of performance expected of workers? If certain technical occupations demand more than the traditional two years of education will the third year become junior transfer to a four year college? In most states this will take legislative action.

Now your attention should be directed aside to a problem outside education and yet affecting workers in general and technical workers in particular. This is the deep rooted problem of the symbiotic existence of man and machine. This means that man and machine, though dissimilar in function and to a degree antagonistic, yet interdependent to the extent that at least one must depend upon the other for existence. Some would say at this moment that man is obsolete. It is, I believe, the hope of all that we can co-exist with mutual benefit to both parties.

Competition forced by a small labor force serving first a war effort then a high birth rate on one end of population and retired group of unproductive workers on the other, industry has been forced to accelerate the rate of introduction of the machine into the production process. Technology has forced the machine ability ahead of the human ability factor. Industry tends to move faster than social organizations.

This imbalance has tended to place man in unfavorable position since he is attempting to compete with the machine on tasks that are more suited to the tireless, numb machine, designed to do repetitive tasks at a high rate of speed. Man has abilities not possessed by the machine of flexibility, creativeness and decision making at a high judgement demand level.

Implications for technical education is to begin to educate man toward the creative, innovative, tasks demanding flexibility, and inventiveness. This implies that we need men that can design, service and program machines, and perform personal service tasks. Leave to the machine jobs wherein it can outdo us.

This is a move toward solving the technological unemployment problem. Schools do not have jobs. Industry makes the decision by deciding which one man or machine can yield a profit.

Should it land in the college bracket, what discipline will most appropriately serve its need. Its placement in a discipline should be predicted on a background of experience and willingness to give worthy consideration rather than a gimic to procure financial grants from industry or the Federal Government. Criterion number one to be met, would be evidence based on experience, a philosophy and an orientation toward work at the applied science level.

Should there prove to be a need for more than two years of education needed for technician we would immediately hit barricade number one, the two year associate of arts degree established by practice and fixed by law. Proposals to this date have been typical of the past, assume a fixed block of time as sacred and consider accelerating the students or call forth a new program under a new name.

Since the inception of this technical occupation, a training period of two years has been judged to be sufficient for the training of workers in it. We have set this into practice and it has existed for all too many years, I believe, without consideration for the demands in this major occupation classification. While there has been an explosion of knowledge in the man made part of our environment,man has changed little in his potential. Some improvement has been realized in the educational process but there is doubt that it has kept pace with the growth of knowledge in our technology. We may well need to think in terms of a three or four year training program for the training of technicians in the more demanding types of technicians jobs.

A problem related to the time spent in school, and the plague of all education, is that of discriminating out the useful in a time of rapid increase in knowledge. If we can make a case for careful selection of content and curriculum in this period of rationing time, in the specialization part of a college curriculum we can with the same discriminating care, garner out the chaff in the general education and include only that which is without question relevant to our society today. We are in mild jeopardy if we provide blind alleys where students may elect to waste their time; we are just short of criminal, if we force all students through inescapable requirements that are a waste of time.

Resistance to Technician Education in 4-Year Colleges

We have accepted without question a two-year block of general or liberal education for the students pursuing a four year academic degree, the man that is not committed to any occupation and the woman that is in preparation for housewifery, and in the same educational circles, by practice deny this liberal education to the student pursuing a technical education. This student in a technical curriculum lives in the same world with the same responsibilities. A retort to this may be, that the technician should get his general education at the high school level before he begins occupational specialization. This same assumption could be made for the professional worker for the common learnings needed by all citizens.

This leads me to raise a new question and that is if we are to look at this thing from a democratic point of view, we may well say that all liberal education or all general education should be given at the junior college level in the first two years, while these youngsters are close at home and only in instances where youth need more than 2 years of education or when they begin to specialize, do they go to a university, state college, or technical institute. All general education would then, we might say, be given at the secondary level (though grade 14), that is all education that is common learning type of education. Any other kind of education would be aimed toward specialization of whatever occupation and it would be given in amounts commensurate with the demands of the occupation and at a time that it is needed. One other concern that will face colleges in the future education will be a continuing sort of thing that man will not complete a degree but will continue to go to school throughout his life. Public schools can well expect to provide this kind of education as a responsibility to a community. Other subsequent topics that might well be discussed are the need for change in curriculum, need for change in courses, even resistance to change.

Inextricably related to education for an occupation of any kind, is a selection process aided by guidance and counseling. Even though we may, from this vantage point, maintain that we have always been teachers, technicians, nurses, secretaries, doctors, lawyers, or mechanics: a movie of our occupational life may well show a series of school and job experiences, some planned and others incident to growing up and making a living; spread over a period of 10 to 15 years. Any number of these, now labeled as casual jobs in retrospect at the time may have been considered to be our niche in life. Ginsberg, in a survey of the job seeking process of youth says that we do not make a realistic occupational choice until near 23 years of age.

The above is not to suggest that we wait until 23 to begin to test our abilities and interests against the broadly conceived major occupational groups in the labor force, but rather to assume that we are in suspension occupationally for a period of time and one way to reduce the risk of a wrong choice early, or the chance that we make a selection from a limited field; youth should be exposed to as wide a range of occupational experiences as is practical.

Since there is little opportunity for work experience prior to 18 years of age, this testing period for most youth is the responsibility of the school. Youth may test their abilities and interests against the nature of tasks in the large families of occupations for technicians in exploratory programs in the secondary school. There can be programs in the broad technologies at the junior high school at an age when youth are testing their abilities against life's responsibilities; in classes in industrial arts, science, and mathematics.

The spectre of changing jobs several times will not absolve us from raising the ability level of each worker to its highest level on each job in the process. We need skilled and efficient workers on even a job that may be obsolete next week. This is misinterpretation of the effect of technological unemployment, when it is used as an argument against specialized occupational training.

Even though technological unemployment is of real concern we should test the incidence of actual skill and knowledge obsolesence against low level skilled workers that are victims of weeding out process. Assuming educational backgrounds ability, motivation, and other attributes as equal it seems more economical to train an experienced worker for the new process than to bring in a stranger to the technology. In the field of electronics, there are few processes wherein, everything is a completely new idea. The demand for diesel mechanics was supplied by retraining auto mechanics in short in-service programs rather than starting from scratch with complete strangers to the mechanical trades.

We not only have confusion among the industrial and educational organizations about technical education, but there are problems of definition of programs within the occupations. Historically we have had two parallels, but at times not closely oriented occupational classification of technical workers; one based on the work performed and the second on training by some licensing agency. Graduates of technical institutes and engineering schools are examples of the latter.

Confusion and lack of clearly defined levels of classification within the technical occupation derive from the nature and level of work performed in this occupation. A further confounding aspect is the rate of change.

Lyn A. Emerson in the publication, "Education for a Changing World of Work: Technical Training in the United States," has suggested four levels or types of training which seem to aid in defining the occupation. These levels are: Narrow-scope limited-level technical occupation; technical specialist occupation ; industrial-type technician occupation; and engineering type technician occupation.

Four levels requiring differing amounts, kind and degree of abilities the word technician, without qualifying adjectives is not too definitive. The following descriptions and titles[1] may assist in setting the different types apart.

There would appear to be a place in the four-year college with industrial technology--or applied technology faculty and facilities to educate some of the technicians in the Industrial and Engineering type technicians. These occupations require high ability, training in mathematics, science, and design.

We frequently encounter the statement that technicians are doing work performed by engineers, which presuppose the ability of some level of engineering. It would appear that the technician assuming same learning rate, must either lengthen training period or sacrifice courses outside specialization in general education.

Actions of State Colleges that would appear to give lasting beneficial aid in the preparation of technicians or technologists for optimum use in the labor force.

1. Proceed to prepare Industrial Arts teachers of a high caliber in the major technologies, to insure strong programs beginning at the grade seven and continuing on through the secondary school. Promote and support industrial arts to the end that all boys and girls be assured an equal opportunity to explore the occupations by experiences in graphics, electrical-mechanical and materials-process technology in each of the secondary schools of the State of Washington.

2. Cooperate with the State Division of Vocational Education in the preparation of teachers for the vocational technical schools and junior colleges technical programs.

3. Provide in-service education for all teachers and supervisors as may be planned cooperatively among all concerned.

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[1] "Education for a Changing World of Work." Appendix I, Technical Training in the United States, U.S. Department of Health, Education and Welfare, 1963, p. 5.

4. Maintain strong programs in the major technologies, graphics communications, industrial mechanical-electronics, and materials process, technology, and industrial design. These programs may follow one of three emphases, work with people, work with materials and processes engineering and creative innovator or designer. Common to all of the curricula will be background of mathematics, science, communication skills and conceptical level of skill development in the broadly conceived technologies. In addition to technical specialization each student will elect a supporting field consistent with his goal--people, technical, or design, in psychology, mathematics, science and art.

5. Provide within regular industrial arts and technology programs for the technical or even terminal and pre-professional students.

6. Devote resources and talents of State Colleges toward cooperatively planned research with industry, State Department of Public Instruction, the Federal Government and its agencies, and school districts.

7. Continue to operate Graduate Programs for Master of Education and develop the Master of Arts Degree with concentration in Industrial Education and Industrial Arts Technology.

REPRESENTING PRIVATE COLLEGES

Thomas J. Killian, Assistant to the President
for Science and Engineering
Seattle University

To this date private colleges have provided little, if anything, in the educational programs for the technician although he is essential to the engineers being graduated from these schools. This is due to a variety of reasons. Admitting that a shortage of engineering technicians exists, should private colleges with their limited facilities and funds get involved in this no-man's land between the highly trained craftsman and the engineer-scientist? Granted that the apparent technical manpower shortage may be due more to a lack of sufficient qualified technicians than of engineers, what contributions can private colleges make? Of course a number of the undergraduates who do not survive a four-year engineering education eventually do become engineering technicians. It has been pointed out earlier that the main difference between the competent young man who wishes to become an engineer and the one desiring training as an engineering technician is one of motivation. The individual who prefers working with his hands to struggling with theoretical abstractions prefers practical technical training rather than mathematical and theoretical studies. However, if there is a shortage of technicians, and there seems to be some doubt about this, there is no doubt that the private college can make large contributions.

In industry the engineering technician is the connecting link between the expert craftsman and the engineer. It is his responsibility to translate the language of the engineer to that of the craftsman. It is his responsibility to make the impedance match between theory and practice. A problem facing the private college is the general lack of agreement regarding what qualifications a technician should have. It is generally agreed that the quality of his curriculum should be high, but there is little agreement regarding its level. Private colleges also are interested in whether a technician training program is an immediate emergency program, of intermittent range or of long range.

Let us look to the possible strength and weakness of private colleges in contributing to an engineering technicians training program. On the positive side the colleges have the administrative and planning competence. They can attract and hold good teachers. In general their physical facilities are adequate. In the basic science courses of mathematics, physics and chemistry and in the non-technical courses such as those of communication, economics, history and management, the contributions would be outstanding. Furthermore, the schools of education of private colleges could make significant contributions to the science and practice of vocational training.

On the negative side the private colleges are not excited over the apparent disinterest in the level of technical training. I believe that in the Pacific Northwest there is only one institution, the Oregon Technical Institute, which is accredited by the Engineering Council for Professional Development. In 1958 less than half of the students in engineering-related occupational curricula were in ECPD listed institutions. Yet the great majority of engineering students are enrolled in schools with ECPD accreditation. Efforts to raise the level of technical institutes are showing increasing success, but the results are not outstanding here in the Pacific Northwest although the ECPD requirements are considered minimal. This is borne out by the fact that graduates of Wentworth Institute or of Oregon Technical Institute are in as great demand as graduates of M.I.T. or the University of Washington.

The great success of the ESMDT program before and during the last war is an indication of what private colleges may be expected to accomplish in an emergency. The rapid acquisition of competence in private colleges in new fields such as solid state physics, nuclear engineering and space and computer technology, and their integration into college programs are evidence of what may be done on a long-range basis. In certain technician areas such as medical technology and computer technology, colleges have made great professional advancements possible. I believe that this may also be done in other fields of engineering technology.

REPRESENTING VOCATIONAL-TECHNICAL INSTITUTES

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The vocational-technical school or institute defines itself by title as an institution that performs that task of training the technicians. If we grant the normally accepted definition of the technician and his role in industry then the performance of the technical institute is carrying out this function and their future expansion to meet this need is an undeniable one. The technical institute has and will continue to prepare the skilled craftsman for all fields in the community and the normal expansion of the skilled trades program required within these institutes naturally encompasses the technician training program. Only as the technician is able to perform his catalytic action of interpreting the theory of the engineer or research scientist into understandable working blueprints for the skilled craftsman can the team function. Thus, in my estimation, the technician's worth is built upon his ability to communicate and to demonstrate in specific craft skills the method and worth of the theory of the engineer and thus carry to completion the idea, that for lack of "know how" would die aborning. Therefore, the program which currently is built upon this base of craftsmanship can carry out most effectively the mission of educating the technician. In my opinion, this program is now in the vocational-technical institute.

Scorning the barbs and witticisms tossed at the title of "reactor" in yesterday's meetings and donning the cloak of reactor for the moment in an honest effort to fulfill this function of reacting (not only to Dr. Baily's excellent presentation but also to what was said yesterday and perhaps also to my total environment including my morning breakfast): I would like to point out that there are many questions that have been raised concerning the employment outlook of, the importance of, the programs for, and even the need of technicians. Although I do not agree with all of the conclusions I believe that many of these questions are answered in the Appendix 1 section of the Report of the Panel of Consultants on Vocational Education entitled, "Technical Training in the United States."

In commenting on Dr. Baily's remarks I feel that I should point out that we must distinguish between questions which call for a discussion of the techniques of training and the basic elements of knowledge which the technician takes with him into his position. Asking whether the training program should be all related material, heavily loaded with demonstrations, scientific principles, necessary mathematics or if it should also include some manipulative work and practical problems begs the question. Dr. Baily, I believe, answered this himself when he said, "It appears and in reality it may well be that the technician is a part of a continuum of workers, some place above the skilled craftsman's level and somewhere below the level of the theoretical engineer. The technician is possibly a liaison person between the two groups, who must be familiar with the technical problems of production as well as the scientific principles involved. The technician is a person who can communicate with each group. "Thus it appears that if we turn out an individual who does not have manipulative skills and cannot deal with practical problems he is not, by definition, a technician.

This same comment might be applied to the question, "Would some kind of a work school program be desirable and effective?" Certainly the acquisition of work skills and the establishment of communication rapport with the work area is necessary for anyone moving into the technician field. This again is a technique and does not need to be related to the fundamental problem of the actual curriculum program for the technician's training.

I believe that the vocational-technical viewpoint is, as Dr. Baily pointed out, "...that the technician is a part of a contimuum of workers," and since technical education, as is the trade education which precedes it, is a part of preparing individuals for a job, it is rightfully an extension upward of what is already being done. The gap, they feel, between trade education and the professional engineer or research person can be closed by the extension of the vocational-technical institute curriculum to provide for the technician's training. The support which the technician is able to give to professional people is always thus firmly anchored in the base of the craft skills in which he has his training.

I might point out, however, that some of the following ideas be kept in mind in this development of the technician program:

1. The technician market is a national, even an international one. Preparation of these persons cannot be limited to local conditions. This will call for a far better job opportunity communications program and a far better job prognostication program than we currently have. I believe that we should call upon the research and manpower resources of the Department of Labor to undertake the improvement and effectiveness of these areas as soon as possible.

2. When we discuss the training of the technician we are really dealing with the philosophy of educational institutions, and in the light of these philosophies, the role that they may play in training the types of technicians that cover a broad picture of needs in industry and which have relationships to the fundamental skills and the supporting roles of these positions. We haven't the time here today to touch upon these philosophical differences but we need to recognize these differences as we discuss the technician's educational program and the role these various institutions may play.

3. Many excellent industrial and vocational courses and curricula have been developed by the schools. All levels of education must join hands and must continue to explore new curricula and relate them to community needs.

4. The schools must establish more uniform definitions of programs and must relate curricula to standardized job descriptions and names which, it is hoped, industry and employment departments will also utilize.

5. Post-high-school entrance requirements must be continuously reevaluated and must give consideration to newly developed courses

and curricula as well as to those which have been standardized for many years, whether such courses relate to vocational or academic areas.

6. All levels of education must relate plant and equipment requirements to the type and scope of instruction required.

7. School administrators, school boards, communities and legislative groups must give more consideration to revising the tax and financial bases currently applied to various levels of education.

8. Counseling and guidance at all levels of education must be objective and related to the needs of the individual being counseled and to society, rather than being related to the background of the counselor.

9. All levels of education must work cooperatively together to define their areas of responsibility and to eliminate as much duplication as possible.

10. Every level of education must effect greater coordination with industries of all sizes. They must train staff or conduct continuing cooperative studies of industrial problems and relate these findings to curricula and student guidance.

11. The schools have a major responsibility to make certain that industry and the public are more aware of the programs currently being offered, and of the schools' willingness to participate in the development of new programs as needed.

There is no doubt that the shortage of technicians currently and in the future will place a severe strain on the ability of the vocational-technical institutes and other institutions to meet this demand. I do believe, however, that through the rapid expansion of these programs where they are now adequately organized, where they are realistically equipped, and with the aid of the institutions of higher education in providing adequately trained teachers and administrators and needed research, this urgent development of the adequate training of technicians for our society of today and tomorrow can be met.

EDUCATIONAL PROGRAMS FOR SUPPLYING TECHNICIANS: THE ROLE OF THE UNIVERSITY

Joseph L. McCarthy, Dean of the Graduate School
University of Washington

In our rapidly changing society, the social fabric becomes increasingly complex. We see increasing specialization of tasks and the consequent need for increasing specialization in the preparation of young men and women to carry out these tasks.

As one specially concerned with advanced teaching and research programs in many fields throughout a university, and also as one who has been personally engaged in teaching, research, and practice as a professional engineer for many years, I recognize clearly the particular need in certain fields for young men and women to serve in a technician capacity intermediate between that of the professional practitioner and that of the skilled [illegible].

It seems to me that there are three ways by which the universities may assist in increasing the number of technicians.

First, as the traditional source of teachers, the universities can develop and offer programs for the training of the teachers who may provide instruction to technicians. To do this effectively, a university will need carefully to establish the need for technicians in the various possible fields, then to appraise its own resources and capacities, and finally to identify and develop those particular teacher training programs which it may be best suited to offer.

I should think that a good teacher training program at a university might well be based upon close collaboration among five different groups, i.e. (1) the professional school or specialized personnel such as professors in schools of medicine, engineering, or architecture, (2) the pedagogical school personnel such as professors expert in best methods of teaching and organizing and presenting information, (3) the practitioner personnel drawn, perhaps on a part time basis, from industry or business who can convey to the technician teacher trainee detailed knowledge of the current industry or business practices which will be important to the trainee in a particular field, (4) the intern supervisory personnel who are highly competent, experienced and actively engaged in the teaching of technicians and can provide guidance and supervison to new instructors while they acquire some experience and maturity in teaching and finally (5) the "refresher" personnel, including professionals, pedagogs, and practitioners, who can bring the technician teacher up to date by their offerings as "in service" courses made available at appropriate intervals during the career of the technician teacher.

The second contribution which might be made by the universities is the offering of certain particular technician training programs. The discoveries which often occur at the universities in medicine, engineering, and science and other fields frequently require almost immediately the training of specialized or technical personnel to permit the discoveries to be applied and used in every day life. Expansion of such training activities may be desirable in some cases.

Finally, the third contribution from the universities would naturally be in the fields of research. Information should be collected and evaluated concerning the different types of technical training programs. Experiments of many kinds could be done by professors and graduate students to ascertain how technician teaching could best be done, what are the best teaching materials and teaching aids, and how services could best be used by society.

By these means, the universities can and will desire to join with other agencies in helping to further the education and training of young men and women in this significant field in our society.

WHAT CAN BUSINESS AND INDUSTRY DO?

Stanley M. Little, Jr.

In many ways in this conference the technician has been thoroughly examined; we have heard how he is trained, what his role is in industry; and what his employment outlook is. Now we need to examine what industry can do to help assure that the right man is trained the right way, to do the right job, at the right time. This responsibility falls jointly to the technical schools and industry. It cannot be adequately accomplished without full cooperation from both.

First, industry must identify the role which the technician will play on the scientific technical team. It must take steps to train the engineer to use and work with the technician and assure that engineers are not used on the technicians' work. It must also examine the requirements realistically to determine the numbers required, the types of technicians required, and the jobs to be done.

Secondly, industry must spell out, in understandable, concrete terms, exactly what level of skills, education, and knowledge are required of the technician. These terms must be explicit; and, if necessary, definite levels of requirements must be established so that the schools may be equipped to adequately counsel the potential technician.

Third, industry must provide first-hand knowledge of industrial techniques and requirements by means of carefully planned tours and summer work programs for counselors. This was put into practice two summers ago at the Boeing Company and according to the director of the participating technical school had very worthwhile results.

Fourth, industry must provide a continuing, active program to inform possible future employees of technician opportunities and preparation requirements, through industry-sponsored presentations in high schools and technical institutions.

Fifth, industry must provide incentives for the employee to continue his training so that the constantly changing technical requirements of his job may be met. These incentives can range from off-hour educational opportunities partially or fully sponsored by industry to extra pay benefits for additional skills acquired.

Sixth, industry must assume the responsibility for certain types of specialized training requirements that are difficult or impossible for the schools to meet: situations where very few specialists in a field are required; where production requirements dictate an immediate program of instruction in a new or exotic process; where security regulations require that training be done in-plant. These are examples of training needs that industry can meet more expediently and economically than the educational institution.

Seventh, industry must provide the schools with feedback information on former students as they advance in their jobs. Such information as: ability to adjust; technical competency; and overall attitude would be some areas to be reported.

Eighth, industry must provide the schools with adequate, up-to-date information on future employment trends, and potentials, so that counselors can counsel their students with authority.

Ninth, industry must emphasize, in every possible way and at every opportunity, the necessity for future employees to learn the non-technical aspects of their job: the ability to read, write, and speak clearly and understandably; to recognize the impact of economic and social factors in relation to their jobs; to attain an attitude toward their work that shows pride of workmanship; a willingness to learn new techniques and methods; all of these are essentially non-technical in nature--however, they often spell the difference between a mediocre and a top-notch technician.

The Boeing Company is very interested in the program of education and has assisted schools in the following ways:

1. Instructors from Boeing have been loaned, on a full time basis, to colleges and junior colleges to develop and teach technical programs.

   During the 1959-1960 school year, an instructor from the Training Section was on loan to Lower Columbia Junior College to develop and teach a program for engineering technicians. This effort helped establish a program at that school and also contributed to the development of materials designed to assist other junior colleges, such as students' curricula in design drafting, electronics and instrumentation; day-by-day course outlines; and facilities requirements.

   During the 1962-63 school year we received an urgent request for assistance from the Dean of Instruction, Central Washington College, for help in assignment of a full-time physics teacher. We arranged for a leave of absence for one of our Nuclear Physicists to accept the appointment for the school year. Engineering physics, electricity, magnetism and physical optics were the courses this physicist taught. He has now returned to Boeing but is teaching on his own evening time, Nuclear Reactor Physics at Seattle University.

   Upon their request, assistance has been provided to Western Washington College, that finally brought about the employment and training of an instructor in the electrical/electronics areas.

2. Symposia have been held for education administrators to discuss the implications for general and specific education resulting from rapid and extensive advancements in science and technology.

   At these symposia, key technical and administrative personnel of Boeing discussed the impact of the "technological revolution" upon industry. These meetings served as a forum for exchange of views between educators and industry on mutual problems.

A Secretarial Science Symposium was held at Boeing in April, 1962, for approximately 100 business education administrators and teachers from the Pacific Northwest. The objective of the symposium was to establish a better understanding between business education institutions and industry regarding secretarial needs and specific skills required by large corporations. The day's activities included talks, a panel discussion, plant tour' and luncheon.

3. A special training session on electronics was held for junior college and technical institute instructors. New industrial techniques were explored and course outlines, problems and examples of training aids were furnished to the participants. A total of 65 school administrators attended, representing 34 schools from Idaho, Oregon, Montana and Washington, in 1961, and 74 in 1962 at a similar session.

   The symposium "Boeing Electronics Training Symposium" and similar symposia are conducted to: (1) provide guidance for schools to enable them to shape their electronic technician curriculum to fit industry's needs; and (2) to provide a future reservoir of capable, technical personnel for employment at Boeing.

4. Resource people have been made available for consultation to help schools initiate or update courses of instruction to meet current industrial needs.

   Many of our employees have served as consultants to schools in establishing programs in the areas of data processing, technical illustration and business training. This type of assistance has involved conferences with school administrators, architects and department heads concerning the feasibility, space and equipment requirements, costs, and technical capability required to establish and conduct programs of training.

5. Visits to the Boeing research, engineering, and manufacturing facilities for selected groups of instructors and students have been arranged to provide first-hand knowledge in areas of specialization.

6. A work-study program in secretarial and office practices has been established with the Highline Junior College. Boeing has cooperated with this junior college in inaugurating a work-study program for students in the second year of their secretarial curriculum. At present, three students are employed part time at Boeing while pursuing their course of studies at the Junior College. Action is underway at this moment to augment and increase the number of participants in this education-industry cooperation program.

7. One of our employees is currently on a full-time assignment working with the State Department of Education to compile, develop, and document an entire design technology program. National interest has developed also. A federal agency concerned has offered full support and cooperation for this much-needed vocational document. They also expressed enthusiasm for the quality of this industry-education-government cooperation.

In summary, it appears that the most important thing that industry and business can do is summed up in one word--"Communicate."

WHAT CAN EDUCATION DO?

Herman N. Miller, Assistant Superintendent for Vocational Education,
Washington Department of Public Instruction

A Look At Where We Are

A review of the annual statistical reports prepared by the U.S. Office of Education for all programs in the United States showed that the State of Washington has a vocational attendance record considerably above the average. Though the State ranks 23rd in population, enrollment reports from the various states in vocational classes show that Washington is 26th in numbers of students attending Agriculture programs; 17th in Distributive Education; 13th in Home Economics; 7th in Trade and Industrial Education; 11th in Practical Nurse Education; and 2nd in Technical Education. The summary report showed that Washington had 10,155 enrolled in Agriculture; 5,658 taking Distributive Education courses; 51,328 enrolled in Home Economics programs; and 71,126 in Trade and Technical Education classes. Of these numbers, 1780 were enrolled in pre-employment courses in Technical Education, distributed as shown by the following table:

Technology	No. of Schools	Total Enrollment
Civil Construction	3	54
Electrical	1	38
Data Processing	10	285
Electronics	11	855
Instrumentation	3	93
Engineering Aides	6	431
Metallurgical	1	24
		1,780

In technical extension classes approximately 12,000 were enrolled in 100 different course titles. The number of students enrolled in technical programs has dropped slightly in community colleges; however, the increased enrollments in the vocational-technical schools accounted for a State-wide gain of 513 in preparatory courses and 1,040 in extension classes during the past year.

Effect of Federal Funds

Prior to the National Defense Education Act of 1958, which provided funds under Title VIII to extend and improve Technical Education, only three community colleges offered technical courses. Eight additional community colleges now offer some technical industrial courses. Over the past five-year period approximately $3,200,000 of State and local money and $1,300,000 of Federal funds have been expended for the development, expansion and improvement of Technical Education in the State of Washington. The amounts expended have been almost doubled each year. The stimulus provided through Federal subsidy to the technical program is clearly evident when growth of programs is compared with the regular program that had much less Federal assistance. Few community colleges have shown expansion in the regular trade and industrial program.

Costs of the Program

Factors having the greatest limiting effect on the development of Technical Education programs are the amount of money required for capital equipment and operational costs. Figures gathered on a national level indicate that the operating costs of quality technical programs average approximately $800 per student per school year while initial capital outlay for post-secondary technical training programs average from $3,000 to $4,000 per student, depending upon the type of technical shop being equipped.

Other Technical and Semiprofessional Courses

In addition to the courses and attendance previously mentioned, there are several technical or semiprofessional programs that receive financial assistance through Federal funds. These include programs of Practical Nurse Education that are offered in all of the community colleges and vocational-technical schools and Forestry Aide Technician courses offered in three community colleges. The Forestry Aide Technician courses are conducted under the Manpower Development and Training Act and at present have approximately 100 trainees enrolled. Of 60 students enrolled in the three community colleges last year, only one did not take employment last summer in the field for which he was trained. It is of especial interest to note that all of these students have reported to complete their programs this fall. Last year 1,170 students were enrolled in practical nursing and 135 in dental assisting programs.

In addition to the technical and semiprofessional programs presently being operated, others in the planning stage include Dental Hygienist, Medical Laboratory Technician, Medical Secretarial Technician, Agricultural Technician, Mid-Management programs in the distributive field, Food Administration, Nutritional Technology, and Clothing and Textile Design programs in the home economics area.

Some Things Required to Assure Successful Technical Programs in Community Colleges or Area Vocational-Technical Schools

Staff members of the Panel of Consultants on Vocational Education stated that community colleges and area vocational-technical schools can do a good job of training technicians if certain conditions are met:

1. The leadership of the institution really understands the task of technical training.

2. Proper curriculums are developed to meet occupational needs.

3. Adequate equipment of appropriate type is provided.

4. Properly qualified staff members are secured.

5. Student selection is carefully done.

6. Good relationships and close communication with industries served are maintained through appropriate and active technical advisory committees.

7. Careful selection of teachers, including programs of teacher preparation and in-service training.

8. Continual research is carried on to determine needs, including curriculum changes and the addition of new programs in other occupational areas to assure that training is keeping pace with trends and developments in the various technical fields.

The programs will fail.....

1. ...if the school endeavors to use pre-engineering curriculums to train technicians.

2. ...if a higher percentage of general education is included in the courses than the students will accept.

3. ...if technical students are given status below academic or transfer students.

Trends Affecting the Need for Technical Training

A recent report by the Bureau of Labor Statistics in the Department of Labor showed that automation and mechanization were reducing jobs at the rate of 35,000 to 40,000 per week. It was also emphasized that the routine jobs in the single or low-skilled level were the first to be automated and therefore persons losing jobs through automation were generally among those characterized as common laborers or single-skilled operators. Examples of the decline in jobs was shown in the following report:

> In the meatpacking industry over the past five years, 36,000 jobs were eliminated but more meat was produced and processed.
>
> Though more automobiles were built during the 1950-1960 period, employment in the automobile manufacturing industry dropped 170,000.
>
> In 1937, 445,000,000 tons of coal were produced with 492,000 workers; in 1961, 403,000,000 tons of coal were produced with 151,000 workers, a reduction of 70%.

Other examples include the all-number telephone dialing system, automatic elevators, and many other less evident occupational areas.

Our national increase in employment has been in areas requiring more education and training. The greatest increase of workers percentage-wise has been in the professional and technical fields--owners and managers, service workers and skilled trades have followed in that order. The percentage of unskilled workers and farm laborers have declined. The biggest problems in unemployment occur in the extremes of our age groups. The rate of unemployment for youth is about double the average and older workers, 45 and over, do not experience a markedly different rate of unemployment than do workers in other age groups, but once out of work, reamin unemployed for longer periods of time. Minority groups and the poorly educated have approximately twice as high an unemployment rate as found in other classifications. In reviewing these statistics, it is recognized that parents, school people and industry must change their attitude toward the type of schooling that prepares people for work. There is no stigma attached to training that will qualify a young person for an opportunity to enter a skilled or technical field. Unemployment in many instances can be reduced by a new approach to education and training. The failure to retain young people in school and to provide training that will fit them for useful employment is a serious charge against society. The money spent on education brings a far greater return than that used to maintain correctional institutions or to provide welfare doles to the uneducated and untrained unable to adequately support themselves or their families.

Agenda for Action

In order to meet the demands for technicians for all areas and to prepare young people for openings in the technical fields and to update the present work force, we must expand and improve all forms of training, increase and improve counseling and guidance services, develop better national and local information on manpower sources and requirements, make full use of all placement services, provide training for more occupational fields, provide more and better equipment and facilities, improve and enlarge teacher and leadership programs, develop instructional materials of quality for all programs, and encourage research and development in vocational and technical education on local, State and national levels. Legislation now pending before Congress, if it becomes law, will be of great assistance in expanding and improving vocational-technical programs in many occupational and geographical areas. H.R. 4955 (The Vocational Education Act of 1963) and the Manpower Development and Training Act both have provisions that will assist in the expansion and improvement of present programs in Washington. The State Board for Vocational Education and the staff of each of the vocational services stand ready to cooperate with all agencies, schools, organizations or industries in furthering technical programs in our community colleges and vocational-technical institutes.

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